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ABSTRACT

This publication is a summary of the energy education programs that existed upon the creation of the Department of Energy. It serves to review the history of federal energy education efforts and as a starting place for the comprehensive mission of this new department. This publication is limited in focus to educational institutions, but it deals with some of the research activities of university facilities. Organizationally, this document has six parts. Part one is an overview. Part two summarizes both student and teacher energy education training efforts. Part three discusses the development of energy curriculum materials. Part four describes some past educational special events such as science fairs, workshops, seminars, and special studies in energy education. Part five discusses past efforts by federal energy agencies. The last part describes the energy extension service efforts directly relating to schools. The purpose of this publication is to more clearly define the educational responsibilities of the Department of Energy. (MR)

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DOE/IR-0008

Activities of the Department of Energy in Energy Education

A description of programs for schools of the Department of Energy and its predecessor agencies

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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United States
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Assistant Secretary for
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ACTIVITIES OF THE DEPARTMENT OF ENERGY IN ENERGY EDUCATION

A description of programs for schools of the Department of Energy and its predecessor agencies

March 1978

U.S. DEPARTMENT OF ENERGY

Assistant Secretary for Intergovernmental and Institutional Relations

Office of Education, Business and Labor Affairs

Washington, D.C. 20545

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Introduction

The Department of Energy's responsibilities in implementing President Carter's National Energy Plan include identifying the appropriate role of educational activities and institutions in that work. Education serves the first principle of that plan : "....that the energy problem can be effectively addressed only.....by a public that understands its seriousness...." In addition, education produces the necessary manpower, at all levels and in all fields, required for the timely development of new energy resources and in improved energy conservation efforts.

This staff study was conducted by Mr. John Ortman under the general direction of Mr. Donald Duggan of the Education Programs Division of the Office of Education, Business, and Labor Affairs. The study represents a snapshot of educational activities as they existed upon the creation of the Department of Energy, as well as a starting point for the development of activities appropriate for the comprehensive mission of the Department. Note that we have limited the study to the activities as they relate to educational institutions, but with the deliberate exception of the very substantial research activity conducted through university facilities.

The Education Programs Division serves as a "port of call" in the Department of Energy to those concerned with the role of educational processes and institutions in implementing the National Energy Plan. Readers are encouraged to provide us with comment on this study.

J. C. Kellett, Jr.
Director
Education Programs Division

THE ROLE OF DOE IN ENERGY EDUCATION

I. Overview

The purpose of this report is to describe the various programs the Department of Energy and its predecessor agencies have administered for our Nation's schools. This will help to answer some of the many questions raised by the public as to what the Federal Government, and the Department of Energy in particular, have done and are doing to prepare the U.S. citizenry to meet the energy challenges of the future. It will also assist school administrators, educational planners, and DOE program managers by identifying worthwhile education programs.

This report will include programs of the Atomic Energy Commission, the Federal Energy Administration, the Energy Research and Development Administration and the Department of Energy.

There are five major areas in which the Department of Energy and its predecessors have played a significant role in supporting and coordinating education related programs in the U.S. These areas are (A) training, (B) curriculum development, (C) educational special events, (D) facilities support, and (E) the Energy Extension Service.

A. Training

Before discussing the various training programs under the Department of Energy's administration, an important and essential feature of all DOE training programs must be mentioned here; and that is DOE's commitment to the policy of providing equal employment opportunities for minorities and women in energy-related careers.

The first Federal energy-related training program to emerge, grew out of research and training activities by college students and faculty at National Laboratories which were sponsored by the Atomic Energy Commission, beginning in 1947. It was not until 1964, however, that these activities were formalized into one program. The primary function of this program is to give college students and faculty the opportunity to enter into collaborative research and training activities over the summer at one of 30 or more DOE Laboratories, Contractors or Energy Research Centers. The program is open to juniors and seniors at the baccalaureate level, graduate students working on their master's and doctoral degrees, and

college/university faculty. In addition to the research-related activities, which reach something in excess of 1,000 students and faculty each year, there are several instructional programs that involve nearly 2,000 students and faculty annually. The funding for the University-Laboratory Cooperative Program in FY 1977 was approximately $3.21 million.

The next training program was also established by the AEC and began in 1948. This program was called the Graduate Fellowship Program. It provided financial assistance directly to students pursuing careers in health physics, industrial hygiene and nuclear science and engineering, and operated for 25 years until its termination in 1973. In this time, a total of $25 million had been spent for the training of 3,320 young men and women on the graduate level.

The Graduate Traineeship Program began in 1965 under the Atomic Energy Commission to provide financial assistance to colleges and universities for graduate student training in nuclear engineering. Later, the program expanded to include training in radiation protection, environmental science and engineering, fusion, geothermal, and solar energy, engineering, conservation and social sciences. The overall goal of the Traineeship Program is to establish a broad base of expertise and technical excellence in the various energy technologies throughout the country. Since 1971, over five and a half million dollars has been spent for more than 850 graduate traineeships.

Since 1966, financial support has been provided by the Department of Labor, the Veteran's Administration, state and local governments, and other organizations, for the training of unemployed and underemployed individuals in energy-related skills for placement in industry. This training is administered under the Training and Technology Program of the Department of Energy's Office of Contractor Relations and is implemented by contractors to DOE, namely, Union Carbide (Nuclear Division) and Oak Ridge Associated Universities (ORAU). Since its inception, over 95 percent of the 4,000 trainees completing the program have been placed in industrial positions, with 36 percent employed at DOE facilities and 34 percent representing minorities and women. A number of community colleges have provided educational services in conjunction with the program.

In 1958, a program of faculty institutes was developed to bring the rapidly developing information in the relatively new

field of nuclear energy to the Nation's educational institutions. Summer institutes of 8 to 12 weeks duration for high school and college/university faculty were conducted in such areas as radiobiology, radioisotope applications, nuclear science and engineering, reactor technology, etc. For several years this program was sponsored jointly by the Atomic Energy Commission and the National Science Foundation. Over 5,000 teachers were trained through these institutes which terminated in the late sixties. This program was the forerunner of the Faculty Development Program of 1971.

The Faculty Development Program began in 1971, under the Atomic Energy Commission, with the original intent of informing teachers about the role of nuclear energy in the production of electrical power. In view of the Energy Research and Development Administration's responsibility for development of a wide variety of energy options, the Faculty Development Program's goals expanded, in turn, to reflect this spectrum of options. The primary goals of the program today are to help improve the teacher's ability in energy education by developing an understanding of a wide variety of energy topics such as solar, geothermal, fossil, nuclear, conservation, and energy economics and to explore ways of effectively communicating this understanding to students. The means used in achieving these ends is the summer workshop which usually lasts from 1 to 3 weeks and involves 25-40 teachers ranging from elementary to the college level. Since the beginning of the program, over 2.74 million dollars has been spent to sponsor 206 workshops hosted by many of our Nation's colleges and universities.

In 1973, the Atomic Energy Commission initiated the Pre-Freshman and Cooperative Education for Minorities in Engineering Program (PREFACE) in order to give minority group students, economically and educationally disadvantaged individuals, and women an opportunity to further their studies in the field of engineering. The major thrusts of the program are: 1) to identify minority group candidates during high school, 2) to provide the candidates with enrichment activities during the summer prior to their freshman year in college, 3) to help them get through the first year of engineering school by providing financial assistance. Thus far, about 500 students have entered the program with a total funding of nearly $400,000. Another $165,000 has been budgeted for FY 1978.

A pilot training program was conducted by the Federal Energy Administration in six New England states, in 1974, in order to create an "Energy Conservation Corps" made up of high school teachers and youngsters trained in conservation techniques for the school and home. The following year, the program expanded to include seven other states in order to establish a nucleus for a nationwide network of conservation-minded young people. The findings of the 1974 pilot program have been published in a report entitled Energy Conservation Training Program: Pilot Program for Six New England States which is available from the National Technical Information Service, Department of Commerce, Springfield, Virginia 22161.

In September 1977, eight universities were chosen by the Energy Research and Development Administration to house solar meteorology training centers. The centers are located in various regions of the U.S. to include Alaska and Hawaii and are expected to be in operation within a year. Each center will offer courses for students and working professionals in solar meteorology and will collect solar radiation data to be fed into the National Climatic Center at Asheville, North Carolina, where it will be made available to those interested. This data will disclose valuable information as to the availability of sunlight across the Nation for solar energy use. The total estimated funding for the 5 year project is 8 million dollars.

B. Curriculum Development

In its continuing effort to assist the educational process in our Nation's schools, the Department of Energy and its predecessors have developed a number of curriculum materials for teachers and students from kindergarten to the adult/professional level. Most of these materials are available, free of charge, from the Department of Energy's Technical Information Center located at Oak Ridge, Tennessee.

Beginning in 1962, the AEC's Division of Technical Information supported the publication of a number of booklets for schools which later were made available to the public upon request.

In 1974, in cooperation with the Pennsylvania Department of Education, the Energy Research and Development Administration supported the development of a mini-course and teacher's guide entitled The Environmental Impact of Electrical Power Generation: Nuclear and Fossil which discusses the national

need for electrical energy and the cost-to-benefit ratio of generating it. This guide has been used in secondary schools, junior colleges and colleges in the U.S.

Beginning in 1975, the Federal Energy Administration has supported the development and distribution of energy and environment resource materials for use by teachers and students, K-12. This material includes a collection of teaching mini-units, a source book for background information for teachers on energy/environment subjects, a five-volume inventory of energy education materials, and a bibliography/film list for teachers and students. In addition, a number of energy education booklets have been devised such as The Energy Challenge, Energy Activities with Energy Ant, Energy Conservation: Understanding and Activities for Young People and My Energy Book.

The Federal Energy Administration initiated a project, now under the Department of Energy, to develop conservation teaching material entitled My Energy World for grades 4 through 6 which is expected to be completed by March 1978.

The total FEA spending for curriculum materials since 1975 is approximately $827,000.

In 1975, the Energy Research and Development Administration initiated a contract with the National Science Teachers Association to prepare a series of instructional units for grades K-12 called "Interdisciplinary Student/Teacher Materials on Energy, the Environment, and the Economy." Thus far, six units have been developed in final form. These units, now available to teachers, are: The Energy We Use, Grade 1, Community Workers and the Energy They Use, Grade 2, Energy, Engines, and the Industrial Revolution, Grades 8-9, Transportation and the City, Grades 8-9, How a Bill Becomes a Law to Conserve Energy, Grades 9, 11, 12 and Agriculture, Energy and Society, Grades 10, 11, 12. Eight additional draft units are being field tested during the 1977-78 school year. In addition, the NSTA has prepared 19 Factsheets for K-12 teachers on various alternative energy technologies and conservation.

In 1976, a home economics curriculum guide was developed by the University of Tennessee under contract to the Energy Research and Development Administration entitled Energy Conservation in the Home. This 325 page publication contains many helpful energy-saving ideas as well as teaching activities

for the classroom. In addition to being suitable for home economics courses, it can be used in other subject areas such as social studies and science.

In the summer of 1977, the Oak Ridge Associated Universities, under contract to the Energy Research and Development Administration, developed four science packets called Science Activities in Energy fo. grades 4 through 6 relating to solar, chemical, and electrical energy as well as conservation. The packets contain a series of experiments for the students to perform and can be used in art, economics, arithmetic, and reading classes as well as science.

The Energy Research and Development Administration contracted for the development of a solar energy curricula for grades K-12. The materials are now being developed by the University of Southern California and the State University of New York at Albany and are expected to be ready for classroom use by September 1978.

In September 1977, the Federal Energy Administration and the Energy Research and Development Administration jointly funded a project to develop 10 energy curriculum modules to be used in community college classes. This effort is currently being undertaken by the Brevard Community College in Cocoa, Florida, and is expected to be finished in July 1978.

In an effort to reach the adult and vocational high school student, as well as the nontechnical student population, the Energy Research and Development Administration and the Department of Energy have recently funded two materials development programs. The first, initiated in September 1977, under ERDA sponsorship, is called "Energy Efficiency Training for Building Trades" and is being produced by the American Association for Vocational Instructional Materials located in Athens, Georgia. The purpose of this program is to provide training materials for vocational/technical high schools, post-secondary schools and adult education courses which will prepare homeowners and future members of the building trades to implement energy conservation techniques. The second, sponsored by the Department of Energy, is a solar correspondence course designed to create a certified work force of solar equipment installers. The course is directed towards technicians skilled in the air conditioning and plumbing crafts and will begin in January of this year and will last 10 to 12 weeks. The course was

developed by the Home Study Institute of Columbus, Ohio, through the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) and the Northamerican Heating and Air Conditioning Wholesalers Association (NHAW).

In early 1978, the Solar Technology Transfer Branch of the Department of Energy initiated a project to develop curriculum materials and procedures for the training of instructors in the teaching of solar equipment installation. Once these materials and procedures are developed, they will be distributed to community colleges and vocational/technical schools throughout the country. The project will be implemented by the League for Innovation in the Community College, a consortium of 16 school districts and 49 colleges throughout the U.S. The funding for the project is estimated at $100,000.

The Solar Energy Research Institute (SERI) was mandated by the Solar Energy Research, Development and Demonstration Act of 1974 and began operations in July 1977, under the Energy Research and Development Administration. SERI will provide significant support to the national program of research, development, demonstration and commercialization of solar energy technologies. Included in its planned activities is the implementation of curriculum development programs and courses for the training of graduate, undergraduate, trades and vocational high school students in the use of solar technologies.

C. Educational Special Events

Several special events concerning energy education have been sponsored by the Department of Energy and its parent organizations such as awards presentations at International Science and Engineering Fairs, expense paid visits to one of the National Laboratories for International Science Fair winners, national contests and competitions designed to encourage nation-wide participation by teachers and students in the creation of energy-related projects, activities and exhibits; conferences, workshops and seminars organized around energy-education themes; special studies and surveys and special visitation programs.

D. Facilities Support

The Department of Energy and its predecessors have provided support to educational facilities throughout the country in

the following four ways: 1) by maintaining the operation of nuclear reactors housed at colleges and universities, 2) by providing funds for the installation of solar electric, solar heating and cooling, and solar hot water systems in school buildings, 3) by sponsoring the development and implementation of school energy conservation programs, 4) by awarding grants of used laboratory equipment to colleges and universities.

1. Reactor Sharing and Fuel Assistance Program

In 1967, under the Atomic Energy Commission, the Reactor Sharing and Fuel Assistance Program was established. Under this program, funds are provided to a number of colleges and universities to cover the fuel production and operating costs of nuclear reactors used for research and training activities. Since the beginning of the program, nearly $5 million has been provided for the reactor sharing and fuel production costs. There are currently 54 reactors, located at 48 learning institutions, in operation.

2. Solar Electric, Solar Heating and Cooling of School Buildings

As a form of direct assistance to the schools, the Energy Research and Development Administration has funded solar electric, solar heating and cooling and solar hot water systems for school buildings. The solar heating and cooling of buildings has been and is currently being carried out under the National Solar Heating and Cooling Demonstration Act of 1974 which provided for the demonstration of solar heating and cooling systems in residential, commercial, and nonresidential buildings including schools. This support provides for the retrofitting of existing school buildings with solar heating and cooling systems and the design and construction of new school buildings for the subsequent installation of solar heating and cooling systems. A total of 40 educational buildings have been chosen as demonstration sites to include elementary, junior high, high school, vocational high school and university/college buildings. Nearly $14.4 million has been spent for the solar heating and cooling and hot water systems of school buildings.

3. School Conservation Programs

In addition to the solar heating and cooling effort, funds have been provided by the Federal Energy Administration to develop conservation programs for school buildings in an effort to cut down high energy costs which result in higher local taxes, increased tuition, teacher layoffs, and, in some cases, school shutdowns. One such program has been developed by the Educational Facilities Laboratories of Menlo Park, California, called the Public School Energy Conservation Service (PSECS). Under this program, energy inefficiencies are identified by a computerized energy audit, and recommendations are made to eliminate them by taking conservation measures such as increasing the insulation, reducing glass areas, and adding new temperature controls, to name only a few. The service was developed in 1974 and is available today, for a small fee, to all interested schools.

In June 1975, the Federal Energy Administration sponsored the "Chicago Project" which involved the auditing of 60 school buildings in Michigan, Illinois, Wisconsin, Ohio, and Indiana. The purpose of the audits was to determine areas of energy waste to make recommendations as to how this waste could be eliminated and how much it would cost. The (PSECS) computer analysis was used as part of the project.

From September 1976, to January 1977, 20 energy conservation workshops were conducted by the Federal Energy Administration's Office of Conservation to provide technical assistance to school plant managers and engineers for energy management in public school and university facilities. The materials resulting from these workshops have been made available to the State Energy Offices.

Beginning in the summer of 1977, 10 elementary schools, located throughout the country, are being retrofitted with energy saving measures such as added insulation, boiler improvements, adjustments in ventilation systems, and changes in lighting. In addition to the energy-saving equipment, data collection instruments will be installed to measure the energy savings for each school. The project is designed to assist school administrators in their conservation programs by providing the basic information

needed to determine effective conservation measures, and is being conducted by the American Association of School Administrators of Arlington, Virginia. It is based on the findings of a (PSECS) survey of the 10 schools by the Federal Energy Administration in 1976. The estimated amount needed to support the project is $600,000.

President Carter's National Energy Act provides for the adoption of a national energy-audits system for school and hospital buildings, pending final approval by Congress. At present, the provisions of the bill are being examined in conference. If approved, it will be the largest conservation effort for schools and hospitals in our Nation's history, providing $900 million in Federal grants over a 3 year period with a minimum of 30 percent of that guaranteed for educational facilities. These grants will cover up to 50 percent of the costs for the evaluation, design, acquisition, and installation of conservation measures.

4. Used Laboratory Equipment Program

The AEC initiated a program in the mid-50's of providing financial grants to colleges and universities to purchase new nuclear-type laboratory equipment. Later this program evolved into a grants program by which used energy-related laboratory equipment was donated to the schools.

E. Energy Extension Service

In September 1977, the Energy Research and Development Administration began funding a 10 state, 19 month, pilot program called the Energy Extension Service. The program provides technical assistance to citizens and other small energy consumers such as small businesses, schools, hospitals, and government agencies. Each state has been awarded approximately $1.1 million and has devised its own particular program, with some of the programs giving a high priority to education related activities. The states participating in the Energy Extension Service are Alabama, Connecticut, Michigan, New Mexico, Pennsylvania, Tennessee, Texas, Washington, Wisconsin and Wyoming. Energy Extension Service activities directly relating to schools are described below. It should be emphasized that these programs have been designed by each state, not the Department of Energy, and will be administered by the states. Those with the principal emphasis on students and/or educational facilities are as follows:

1. Michigan

In Michigan, there are two major energy objectives incorporated within the Energy Extension Service Program. The first is to create an Energy Conservation Ethic in 50,000 high school age young people and the second is to reduce the energy consumption by at least 5 percent in at least 50 percent of the families with members in high school.

2. Texas

In Texas, one of the energy-conservation goals is directed toward public institutions such as local government buildings, state agencies and public schools. In order to achieve this goal, materials are being developed for energy-conservation presentations in schools throughout the state.

3. Tennessee

In Tennessee, an energy conservation program has been designed to reduce energy consumption in city/county buildings including public schools. Conservation activities include removing institutional barriers such as energy inefficient building codes and providing technical assistance for buildings retrofit.

4. Washington

In Washington, there are two major areas in which the Extension Service will assist the schools. First, the state is encouraging energy conservation through improved bus routing and scheduling. Secondly, curriculum materials are being developed that emphasize energy conservation and the use of alternate renewable sources of energy.

5. Connecticut

In Connecticut, public facilities including schools comprise one of the three major target audiences for the Energy Extension Service.

6. Pennsylvania

Pennsylvania has designed a program to provide local officials with information and technical support to improve energy efficiency in school buildings.

7. Wyoming

Conservation and solar technology demonstrations will be presented at seven community colleges and various high schools across the state.

TABLE I

ESTIMATED TOTAL SPENDING IN ENERGY EDUCATION
(1948-1978)

Training		$	Time Period
University/Laboratory Cooperative Program		$ 9,000,000	(FY 76, FY 77, FY 78)
Graduate Traineeships		5,629,000	(FY 71 - FY 78)
Faculty Development Program Workshops		2,741,162	(FY 71 - FY 78)
PREFACE Program		384,000	(FY 73 - FY 77)
Solar Research and Training Centers		8,000,000	(FY 78 - FY 82)
AEC Fellowship Program		25,000,000	(FY 48 - FY 73)
Radiation Protection Training		110,000	(FY 65 - FY 77)
Criticality Workshop		7,000	(FY 77)
Materials		2,248,000	(FY 74 - FY 78)
Educational Special Events		1,691,778	(FY 57 - FY 77)
Facilities Support	(Solar H/C)	14,380,993	(FY 74 - FY 77)
	(Conservation)	1,234,094	(FY 74 - FY 77)
	(Solar Electric)	6,300,000	(FY 77 - FY 79)
Reactor Sharing and Fuel Assistance Costs		4,737,406	(FY 67 - FY 77)
	TOTAL	$81,463,373	

II. Training

A number of training programs have been established to meet the needs of a variety of audiences. These audiences can be divided into two distinct groups: A) students of varying levels (K-12, 2 year post-secondary, baccalaureate through post-baccalaureate, and adult/professional), B) educators (teachers K-12, school administrators, junior college and university faculty members).

A. Students

1. K-12

In 1974 and 1975, the Federal Energy Administration sponsored a training program to prepare young people of high school age to promote energy conservation in their homes, schools and communities. In order to implement this program, junior high and high school students were encouraged to work with their teachers and community leaders on energy conservation programs and activities.

Training and demonstration workshops were set up in 13 states and energy conservation newsletters were provided to members of the "Energy Conservation Corps" covering energy information relevant to their states and guidelines for saving energy in homes and schools.

The Bolton Institute of Washington, D.C., conducted the program under contract to the Federal Energy Administration for a total of $200,000.

The states that participated were Massachusetts, Connecticut, New Hampshire, Vermont, Maine, Rhode Island, Colorado, Michigan, Illinois, Georgia, New Jersey, Alabama, and New York.

2. Two Year Post-Secondary

In the spring of 1965, the AEC initiated a training activity to produce certified radiation protection technicians for the Idaho Nuclear Engineering Laboratory. This activity consists of 2 years academic training in science, mathematics, engineering and related subjects at Idaho State University and one summer of on-the-job

training at INEL. To date, over 100 students have participated in the program at a cost to DOE and its predecessors of nearly $110,000.

In September 1975, a survey was taken by the Manpower Development Division of Oak Ridge Associated Universities, under contract to the Energy Research and Development Administration, to determine the occupational interest in energy related technologies in community and junior colleges in the U.S. and to identify the degree of cooperation between the colleges and energy industries. The survey findings were used to assess the need for future energy related programs involving the exchange of ideas between colleges, industries, and state and Federal agencies. A total of 1,152 institutions were surveyed including members of the American Association of Community and Junior Colleges which represents some 900 2-year colleges.

As a result of this survey, four technology training workshops were held at a conference in Atlanta, Georgia, in October 1976, to examine manpower training in coal mining, petroleum technology, nuclear and solar energy for junior college students. The conference was co-sponsored by the Energy Research and Development Administration, and the American Association of Community and Junior Colleges. The conference attracted representatives from 94 junior colleges and from 37 states.

3. Baccalaureate through Post-Doctoral

(a) The University/Laboratory Cooperative Program

With the establishment of the National Laboratories 30 or more years ago, both faculty and students have been involved in ongoing research programs. The degree of this participation has varied widely depending upon the mission and organization of the particular facility.

In 1964, under the AEC, shortly after the Division of Nuclear Education and Training was formed, this University/Laboratory relationship was integrated into a program activity for coordination purposes and to maximize the opportunities for faculty and students

at additional laboratories. It did not occur, nor was it intended, that all University/Laboratory interactions be combined into one central program. What evolved were essentially complementary type activities, wherein Education and Training funds were used primarily for faculty or students in a training or learning status. Programmatic or research support was still used to bring faculty and students on board, but more directed to program goals and near term needs of the Lab, such as consultant support, in the case of faculty, and part-time or summer student help.

The support of participants with Education and Training funding is generally understood to be for those academic people, faculty and students, whose major interest is in learning or broadening their experience in an area consistent with the Labs' mission or expertise. At the same time, faculty and/or students who are there in a learning status often make valuable contributions to the ongoing research efforts. Laboratory staff are highly supportive of this activity and view it as a valuable bridge in building a cooperative and mutually beneficial relationship with colleges and universities at the undergraduate level.

The organizations administering this program are: Ames Laboratory, Argonne National Laboratory, Associated Western Universities, Brookhaven National Laboratories, Lawrence Berkeley Laboratory, Mound Laboratory, Northwest College and University Association for Science, Oak Ridge Associated Universities, Oak Ridge National Laboratories, University of Rochester, Savannah River Ecology Laboratory and the Savannah River Laboratory.

The University/Laboratory Cooperative Program is composed of the following elements:

1) Faculty Research Participation

2) Student Research Participation (Graduate or Undergraduate)

3) Laboratory Graduate Participation (Thesis Research)

4) Thesis Parts Research Participation (Short Term)

5) Student/Faculty Seminars and Workshops (Lab Oriented)

6) Conferences

7) Visiting Lecturers

8) Return Faculty Research Visits

None of the Laboratories have all of the above activities operating within their programs. Each Lab's particular program is generally geared to the special strengths and mission of that facility. The principal objectives sought through these activities are:

- To encourage and extend a productive relationship between universities and the Laboratories, leading to a broader research and education partnership between the two.

- Provide selected faculty, graduate students, and undergraduate students with useful exposure to the research and development activities of interest to DOE as expressed in the R&D mission of the laboratory.

- Train academic personnel in new techniques and processes of particular interest to the host laboratory and DOE that are unavailable on campus.

- Enrich the instruction and research capabilities of college and university staff in energy.

- Attract students to the Laboratory and other DOE Centers for possible future employment.

The DOE FY 1978 budget for the University/Laboratory Cooperative Program is $3.18 million.

The four major student programs are:

- Student Research Participation - This activity provides qualified junior/senior level undergraduate science and engineering students with the opportunity to participate in research, development and demonstration programs at approved DOE Laboratories or Energy Research Centers. Most, though not all, appointments are for the summer period. The undergraduate applicant must have at least junior standing with a better than average academic record.

  Several facilities sponsor a semester of "honors" programs for upper level undergraduates that combine special instruction in a student's field of interest and need with a research assignment. Credit is normally given by the student's academic institution for this period of work. Graduate students are also eligible for non-thesis research participation appointments.

- Laboratory Graduate Research Participation - Selected full-time graduate students enrolled in accredited universities may receive appointments of up to 1 year--renewable to a maximum of 3 years--to carry out their Ph.D or Master's thesis research in residence at a DOE Laboratory or Energy Research Center. The purpose of the program is to provide opportunities for graduate students to carry out their dissertation requirements when the necessary facilities or resources are not available on campus.

  All requirements for the degree, except the research, are normally completed prior to starting the appointment. The student works under the joint direction of a laboratory staff member and a faculty research advisor who periodically visits the facility to monitor the student's progress. Considerable preplanning is involved between the student, his or her major professor, and the Laboratory, to assure that the proposed research meets the interests and needs of all concerned parties.

- o Thesis Parts Research Participation - This activity provides opportunities for full-time graduate students to conduct short-term portions of their research--a few days to several weeks--at a DOE facility having a special resource or equipment required for the research.

- o Student Experiments - This activity provides students with experience in laboratory experimentation, on a time and space available basis.

It must be recognized that the Laboratories, Energy Research Centers, and other DOE facilities participating in this program, range from the broad multidisciplinary labs to specific mission oriented or single purpose facilities. As such, the range of activities varies widely with few, if any facilities, carrying out all of the programs described (see Table III).

(b) AEC Graduate Fellowship Program (1948-1973)

Beginning in 1948, the Atomic Energy Commission initiated the Graduate Fellowship Program with the intent of providing graduate-level training in health physics, industrial hygiene and nuclear science and engineering, chemistry, reactor technology and other energy-related fields. The total investment of AEC in all these programs is summarized in Table II below:

TABLE II

Program	Fellows	Fellowship Years	Cost (in thousands)
Predoctoral and Postdoctoral	920	1,061	$ 4,382
Health Physics	910	1,381	6,078
Advanced Health Physics	30	77	597
Industrial Hygiene	80	89	466
Nuclear Science and Engineering	1,380	2,457	12,483
TOTALS	3,320	5,065	$ 24,283

TABLE III

ADMINISTERING ORGANIZATIONS	Faculty Research Participation	Faculty Research Visits	Student Research Participation	Laboratory Graduate Research Participation	Thesis Parts Research Participation	Faculty Institutes	Faculty Workshops	Faculty-Student Experiments	Conferences	Visiting Staff Lecturers
AMES LABORATORY	o		o	o					o	o
ARGONNE NATIONAL LABORATROY	o	o	o	o	o	o	o	o	o	
ASSOCIATED WESTERN UNIVERSITIES	o		o	o	o					
BROOKHAVEN NATIONAL LABORATORIES	o		o			o				
LAWRENCE BERKELEY LABORATORY	o		o							
MOUND LABORATORY	o		o	o	o					
NORTHWEST COLLEGE & UNIVERSITY ASSOCIATION FOR SCIENCE	o		o	o						o
OAK RIDGE ASSOCIATED UNIVERSITIES	o	o	o	o	o	o		o	o	o
OAK RIDGE NATIONAL LABORATORIES	o	o	o	o	o	o		o	o	o
UNIVERSITY OF ROCHESTER		o	o	o			o	o	o	
SAVANNAH RIVER ECOLOGY LABORATORY	o		o	o						
SAVANNAH RIVER LABORATORY	o		o	o						

(c) The Graduate Traineeship Program

The present Graduate Traineeship Program evolved from the Atomic Energy Commission's Traineeships which were developed in 1965 to further nuclear engineering education. By Fiscal Year 1975, the program had been expanded to include radiation protection and environmental science.

As the Energy Research and Development Administration replaced the AEC, the Traineeship Program responded to the needs of a range of energy technologies much broader in scope to include fusion, geothermal, solar, social science and conservation. The goal of the Traineeship Program is to strengthen centers of excellence for graduate study in energy related technologies by providing institutions with funding under a traineeship contract to select students for graduate study. Since Fiscal Year 1971, over five and a half million dollars have been spent for more than 850 traineeships at the Master's and Doctor's Degree level (see Table IV).

TABLE IV

	FY 71	FY 72	FY 73	FY 74	FY 75	FY 76	FY 77	FY 78	Total
FUNDING LEVEL (in thousands)	663	564	798	533	846	700	525	1,000	$5,629,000
TRAINEESHIPS	102	88	123	83	149	103	75	133	856

(d) Pre-Freshman and Cooperative Education Program

The PREFACE Program was created in 1973, under the Atomic Energy Commission, for the purpose of increasing the number of minority group members and women entering engineering, science, and other energy-related fields, so that future pools of professional talent will be more equitably represented. Under this program, funds are provided to colleges and universities to seek out minority groups, women, and educationally and economically disadvantaged individuals during high school years and provide them with innovative and motivating experiences prior to their freshman year in

college. During the first summer, the student will spend 2 or 3 weeks on campus in academic work and then several weeks at a national laboratory working in a research environment. The financial support in this program provides summer stipends for the students and tuition costs during the freshman year. Other support comes from industry and university sources. Thus far, over 500 students have participated with a total funding level of $384,000.

(e) Solar Research and Training Centers

In September 1977, the Energy Research and Development Administration announced the selection of eight universities throughout the continental United States, Alaska and Hawaii, to set up solar energy training centers which will offer courses for students and working professionals in solar energy related meteorology. The Energy Research and Development Administration will spend a total of $8 million over 5 years to fund the project. The centers are expected to be in operation in September 1978.

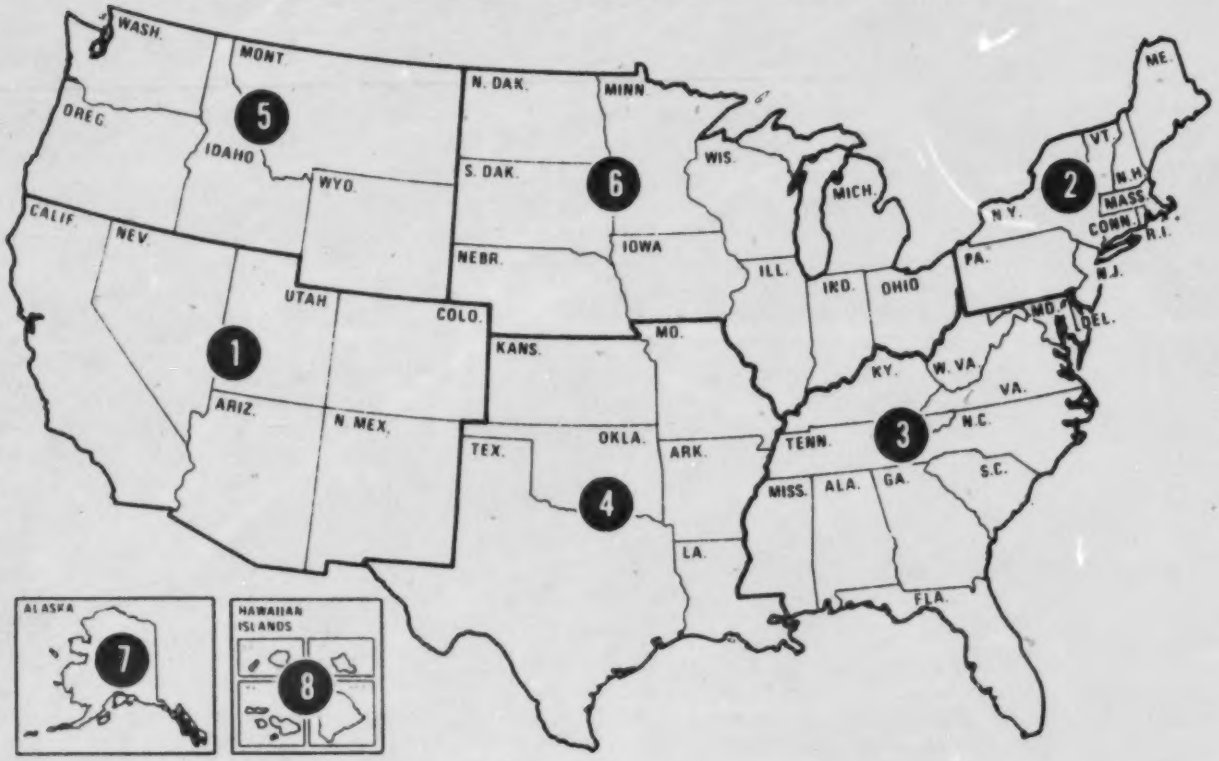
The eight universities are: University of California, Davis, California; State University of New York, Albany, New York; Georgia Institute of Technology, Atlanta, Georgia; Trinity University, San Antonio, Texas; Oregon State University, Corvallis, Oregon; The University of Michigan, Ann Arbor, Michigan; University of Alaska, Fairbanks, Alaska; University of Hawaii-Manoa, Honolulu, Hawaii.

The information gathered on solar radiation and other meteorological data will be fed into the National Climatic Center at Asheville, North Carolina, where it will be available to those interested. In this way, a more detailed understanding of the year-round availability of sunlight across the Nation, including Alaska and Hawaii, will be obtained (see map, page 22).

(f) Nuclear Criticality Safety Workshop

In May 1977, the Energy Research and Development Administration sponsored a 10 day workshop called the

REGIONS FOR
SOLAR ENERGY METEOROLOGICAL RESEARCH AND TRAINING SITES



"Nuclear Criticality Safety Workshop" at the University of New Mexico for the training of 16 graduate students, from all parts of the United States, in safety procedures related to all aspects of the nuclear fuel cycle and reactor usage. The workshop consisted of lectures, work/discussion sessions and informal interaction between students and faculty. A major strength of this type of activity is that it provides for practical experiences in criticality safety which is generally unavailable to students.

B. Educators (Teachers K-12, Administrators, Junior College Faculty, Baccalaureate through Post-Baccalaureate Faculty)

1. The University-Laboratory Cooperative Program

As mentioned earlier, this program not only serves undergraduate and graduate students, but also acts as a vehicle for college faculty research and training as well. Under its Faculty Research Participation activity, full-time college or university faculty members engage in research, working with a laboratory staff member on a problem of mutual interest. Other faculty training and education activities include:

(Faculty Institutes)

These are 1 to 4 week instructional sessions on subject matter relating to the various energy technologies, environmental impacts, conservation and other related topics to aid in teaching and student guidance. (Also includes in-service institutes which meet on a weekly basis during the school year.)

(Faculty Workshops)

These are usually 2 to 3 day sessions on special topics of interest to faculty members. Many of the topics are tied closely to research programs of the laboratory with the objective of filling the gap between the brief treatment given in meetings or conferences and the relatively longer exposure attained as a research participant.

TABLE V

PREFACE FUNDING

(Fiscal Source)	FY 1973	FY 1974	FY 1975	FY 1976	Int. Qtr.	FY 1976	FY 1977
Howard University	$10,000	$10,000	$10,000	$15,000	$10,000	$ --	$ 15,000
Univ. of New Mexico	14,000	25,000	25,000	—	10,000	8,000	11,000
Ohio State Univ.	10,000	5,000	--	10,000	--	--	12,000
Tuskegee Institute	13,500	10,600	15,000	7,500	20,000	12,000	—
Sub-Total	47,900	50,600	50,000	32,500	40,000	20,000	38,000
Dayton-Wilberforce	—		--	--	--	--	22,000
Atlantic Univ.- Georgia Tech	--	--	--	2,000	--	--	--
Savannah River Office	--	—	--	6,000	--	--	--
Other	--	--	--	--	--	--	--
TOTAL (By Fiscal Year)	$47,900	$50,600	$50,000	$40,500	$40,000	$20,000	$135,000

TABLE VI

PREFACE

ENROLLMENTS BY ETHNIC GROUPS

		BLACK		SPANISH		NATIVE AMERICAN		NON-MINORITY	
		M	F	M	F	M	F	M	F
DAYTON	1976	2	1	-	-	-	-	-	1
WILBERFORCE		1	1	-	-	-	-	-	-
	Subtotal	3	2						
HOWARD	1973	12	3	-	-	-	-	-	-
	1974	16	8	-	-	-	-	-	-
	1975	21	5	-	-	-	-	-	-
	1976	19	9	-	-	-	-	-	-
	Subtotal	68	25						
NEW MEXICO	1973	-	-	7	1	2	-	-	1
	1974	-	-	17	3	1	-	-	5
	1975	-	-	13	3	3	1	-	5
	1976	-	-	17	3	-	1	-	4
	Subtotal			54	10	6	2		15
OHIO STATE	1973	10	-	-	-	-	-	-	-
	1974	2	2	2	-	-	-	-	-
	1975	6	2	1	1	-	-	-	-
	1976	6	3	-	1	-	-	-	-
	Subtotal	28	7	3	2				
TUSKEGEE	1973	24	4	-	-	-	-	-	-
	1974	32	8	-	-	-	-	-	-
	1975	51	28	-	-	-	-	-	-
	1976	55	15	-	-	-	-	-	-
	Subtotal	162	55						
TOTAL	1973	46	7	7	1	2	-	-	1
	1974	50	18	19	3	1	-	-	5
	1975	78	35	14	4	3	1	-	5
	1976	83	29	17	4	-	1	-	5
GRAND TOTAL	1973-1976	257	89	57	12	6	2	-	16

	MALE	FEMALE	TOTAL	TOTAL MINORITY
1973	55	9	64	63
1974	70	26	96	91
1975	95	45	140	135
1976	100	39	139	134
TOTALS	320	119	439	423

(Faculty Student Experiments)

At certain facilities faculty members may conduct instructional sessions and experiments with their students on a time and space available basis.

(Faculty Research Visits)

Arrangements may be made for short research visits by former research participants and other college and university faculty members, to continue collaborative research with laboratory staff.

2. Faculty Institutes

In order to inform teachers in our Nation's high schools and colleges about nuclear energy, the Atomic Energy Commission established a program of summer faculty institutes. These institutes were held for 8 to 12 weeks and presented various aspects of nuclear technology such as radiobiology, radioisotope applications, nuclear science and engineering, reactor technology and the like. The program was sponsored jointly by the AEC and the National Science Foundation for several years. The institutes trained an estimated 5,000 teachers. The institute program began in 1958 and operated until the late sixties. This program was the forerunner of the Faculty Development Program of 1971.

3. Faculty Development Program

The Faculty Development Program provides support to colleges and universities for projects aimed at the development of faculty understanding of important subject matter relating to the development, conservation and utilization of United States energy resources. By assisting in the improvement of energy education in the Nation's high schools and colleges, the program plays a significant role in the judicious and orderly development of United States energy resources. The primary vehicle used by the Faculty Development Program in this effort is the summer workshop of 1 to 3 weeks duration. In some instances the program supports other mechanisms for achieving its goals such as academic year activities or local materials development,

with the primary purpose being the improvement of the individual teacher's capability.

The Faculty Development Program began in 1971, under the AEC's program of summer workshops. These workshops were originally funded by AEC to provide factual material through educational channels about nuclear energy. In accord with the Energy Research and Development Administration's responsibility for the entire spectrum of energy options, the Faculty Development Program has been considerably broadened in scope to include solar, conservation, nuclear, fossil, geothermal, and energy economics, as well as general energy education.

Since 1971, over $2.5 million have been spent to sponsor 206 workshops for high school and college faculty (see Table VII).

TABLE VII

FACULTY DEVELOPMENT SUMMER WORKSHOPS BUDGET

YEAR	WORKSHOP TOTAL	NUMBER OF WORKSHOPS
1971	$ 20,000	2
1972	110,000	11
1973	168,880	21
1974	205,190	22
1975	265,093	25
1976	357,526	26
1977	543,000	31
1978	1,071,473	68
	$2,741,162	206

III. Curriculum Materials

In order to bring the energy message to the schools, curriculum materials have been developed by a number of organizations under contract to the Department of Energy and its predecessors. Most of these materials are designed for teachers from kindergarten to the adult professional level, with a few designed for student use. They are available from the Department of Energy's Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830.

A. Classroom Materials

1. Grades K-3

The materials developed or in the process of being developed are the following:

The Energy We Use - This is an instructional unit developed by the National Science Teachers Association (NSTA), under a contract to the Energy Research and Development Administration, containing nine lessons for students on the first grade level. Through this unit students discover that energy is one of the links between them and the world around them.

Community Workers and the Energy They Use - This unit, developed by NSTA for ERDA, contains 13 lessons revolving around the theme of the relationship between the community and energy use. This unit is suitable for second grade students.

Energy Activities with Energy Ant and My Energy Book - Developed by the Federal Energy Administration, these booklets feature a cartoon character called Energy Ant who tells students, Grades 1-3, about energy and how to use it wisely. As outgrowths of these two booklets, two Energy Ant film strips with cassette tapes have also been produced. Single copies of the Energy Ant print materials are available through the Consumer Information Center, Pueblo, Colorado 81009, and bulk copies are available from the Department of Energy, Office of Public Affairs, 12th and Pennsylvania Avenue, Washington, D.C. 20461. The film strips and cassette tapes, What is Energy and What is Energy Conservation, are available for $12.50 through the National Audio Visual Center, Washington, D.C. 20409.

Energy and Transportation - This is an instructional unit developed by NSTA, under an ERDA contract, containing seven lessons emphasizing the history of transportation and how it relates to energy. The unit is prescribed for third graders. (Field Test Draft)

2. Grades 4-6

Science Activities in Energy - This is a science package for Grades 4-6 containing four file folders of activities and experiments. The topics are Solar, Electrical and Chemical Energy as well as Energy Conservation. The approach used to implement the lessons is a "hands-on" approach with students constructing and manipulating materials in order to discover fundamental scientific relationships. These packets were developed by the Oak Ridge Associated Universities under contract to ERDA.

My Energy World - This is a set of four spirit master file folders on conservation containing spirit master duplicating activity sheets for students from Grades 4 through 6. The contract to develop this material was funded by the Federal Energy Administration.

In addition to the above materials, NSTA, under contract to ERDA, is in the process of developing four sets of learning materials dealing with conservation, fossil fuels, nuclear and solar energy. The packets are being designed for use in science and social studies classes and are expected to be completed in September 1978.

Another project, which is currently being developed by the University of Southern California, provides for the development of solar energy materials for K-6 students. This project began in the summer of 1977 under a contract to the Energy Research and Development Administration.

3. Grades 7-9

The Energy Challenge - This was developed for the FEA for use in junior high school classes and provides 24 duplicating master activity sheets along with teaching guides. The booklet contains lessons on energy subjects such as fossil fuels, solar energy, new energy technologies and conservation. It is now being revised for reprinting.

Energy Conservation: Understanding and Activities for Young People - This 24 page booklet was developed by the Office of Conservation Education of the Federal Energy Administration and discusses the meaning of energy, its sources and limitations, and conservation activities.

Energy, Engines, and the Industrial Revolution - This is an instructional unit developed by NSTA for ERDA. It includes five lessons demonstrating the relationships between the Industrial Revolution and energy use.

Transportation and the City - This unit developed by NSTA contains four learning activities dealing with energy consumption, supply and demand relationships, the development of suburbs and urban transportation. It was developed for ERDA and is used in eighth and ninth grade social studies classes.

Mathematics in Energy - This is an instructional unit developed by NSTA under contract to ERDA containing seven learning activities using energy as a basis for mathematical computations. (Field Test Draft)

An Energy History of the United States - This instructional unit, developed by NSTA under contract to ERDA, traces the history of primary energy sources used in our Nation's history; the three energy sources discussed are wood, coal and oil. (Field Test Draft)

4. Grades 10-12

In cooperation with the Pennsylvania Department of Education, the Energy Research and Development Administration supported the development of a mini-course and teacher's guide, in 1974, entitled The Environmental Impact of Electrical Power Generation: Nuclear and Fossil which discusses the national need for electrical energy and the cost-to-benefit ratio of generating it. This guide has been used in secondary schools, junior colleges and four-year institutions in the United States. The Department of Energy recently contracted to update and revise this material to reflect current knowledge and policies.

Agriculture, Energy and Society - This instructional unit, developed by NSTA under contract to ERDA, examines the relationship between energy and the agricultural community and discusses the influence of agriculture and food production on society.

Energy Conservation in the Home - This home economics curriculum guide was developed by the University of Tennessee, under contract to ERDA, and contains a number of conservation activities for the home. It also discusses a number of ways to save energy and explains the major causes of energy waste.

How a Bill Becomes a Law to Conserve Energy - This instructional unit, developed by the NSTA under contract to ERDA, traces the steps involved in the passage of a law by Congress focusing on the 55 MPH Speed Limit Law and how it affects energy conservation. The unit is composed of seven learning activities.

Energy in the Global Marketplace - This instructional unit, to be developed by the NSTA under contract to ERDA, discusses the worldwide economic impacts of international energy use and supply and demand.

United States Energy Policy-Which Direction? - This instructional unit, developed by the National Science Teachers Association for ERDA, examines the role of the Executive Branch of Government in making national policy decisions as they relate to energy. (Field Test Draft)

In addition to these titled products, DOE is supporting the development of additional interdisciplinary units by NSTA, vocational/technical material on energy conservation in buildings by the American Association for Instructional Materials of Athens, Georgia, and a solar curriculum for Grades 7-12 by the State University of New York at Albany.

5. Junior College

In early 1978, the Solar Technology Transfer Branch of the Department of Energy initiated a project to develop curriculum materials and procedures for the training of instructors in the teaching of solar equipment installation. Once these materials and procedures are developed they will be

distributed to community colleges and vocational/technical schools throughout the country. The project will be implemented by the League of Innovation in the Community College, a consortium of 16 school districts and 49 colleges throughout the United States. The funding for the project is estimated at $100,000.

Also being developed are 10 modules concerning energy and conservation for use at the junior/community college level. These modules are being developed by the Brevard Community College of Cocoa, Florida, with joint funding from the Federal Energy Administration and the Energy Research and Development Administration.

6. Baccalaureate

In 1976, under the Energy Research and Development Administration, the Historian's Office established the Visiting Scholars Program whereby two university professors are invited, annually, to work at DOE headquarters in Washington, D.C., to develop courses on the history of energy. These courses discuss the political, economic, technological, and social aspects of energy development and distribution. Once developed, they are used in universities, liberal arts colleges, technical schools, and community colleges. In FY 1976 and FY 1977, a total of $173,000 was spent for this program; the universities contributing $30,000 of the total.

In August 1976, the Energy Research and Development Administration funded a project to develop course materials in "Quality Assurance" for the design, fabrication, and construction of nuclear power plants. These materials have been used by colleges and universities at the undergraduate level and were developed by North Carolina State University.

7. Adult Education

In the process of being developed are two curriculum projects directed to meet the needs of adult students. The first is a home-study course in the installation and maintenance of solar heating and cooling equipment for technicians with air conditioning and plumbing skills. This course is being developed, under contract to DOE, by

the Home Study Institute of Columbus, Ohio, through the Sheet Metal and Air-Conditioning Contractors National Association (SMACNA) and the Northamerican Heating and Air-Conditioning Wholesalers Association (NHAW), and is expected to begin in January 1978, at a cost of between $75 and $100. To ensure a high rate of completion, the Department of Energy plans to establish an outreach homework assistance program to be administered through five National Laboratories: Lawrence Livermore Laboratory, Livermore California; Oak Ridge National Laboratory, Oak Ridge, Tennessee; Brookhaven National Laboratory, Upton, New York; Sandia Laboratories, Albuquerque, New Mexico; and Battelle Pacific Northwest Laboratory, Richland, Washington. The course is designed to produce certified solar heating and cooling technicians.

The second adult education materials development project underway, described above as vocational/technical material, is the "Energy Efficiency Training for Building Trades" being developed by the American Association for Vocational Instructional Materials of Athens, Georgia. These materials will be used for adult education classes for homeowners and future members of the building trades as well as for high schools and post-secondary schools.

In addition, an energy film catalog is available, free of charge, by writing to the Department of Energy Film Library, P.O. Box 62, Oak Ridge, Tennessee 37830.

B. Background Information for Teachers

In 1975, the Federal Energy Administration supported publication of a three-volume work consisting of an Energy-Environment Source Book which considers economic, social, and environmental issues; an Energy-Environment Materials Guide which contains an extensive annotated bibliography and film list for teachers and students; and an Energy-Environment Mini-Unit Guide which includes classroom activities for Grades K-12. These materials had been developed by NSTA under contract with the U.S. Office of Environmental Education.

In 1977, the Federal Energy Administration supported the development of a five-volume study listing titles and sources of energy education by media for use in Kindergarten through 12th grade entitled Energy Education Materials Inventory. The volumes include print materials, audiovisual materials, 16 mm films, kits and games, and reference sources. A project is now underway to verify and annotate this inventory.

In 1977, the Energy Research and Development Administration announced the publication of Award Winning Energy Education Activities which contains 10 energy-related learning activities for elementary, junior high and high school teachers. Also made available that same year were 19 Factsheets for teachers on alternative energy sources and conservation, written by the National Science Teachers Association.

C. General Energy Information Available to Schools Upon Request

In addition to materials specifically developed for schools, a vast number of booklets, pamphlets, and posters have been made available, upon request, from the Department of Energy and its predecessors to all interested individuals. Many of these requests for information have been forwarded by teachers and school personnel. From 1962 to 1974, the Atomic Energy Commission sponsored the printing and distribution of over 12 million copies of 84 booklet titles relating to atomic energy. During this time, a total of 360,000 copies of six posters were distributed to school libraries and resource centers. The total estimated cost for the above materials was $1,247,063. From October 1974 to October 1977, the Energy Research and Development Administration supported the printing and distribution of over 6.5 million booklets and pamphlets and 100,000 copies of the Energy History Chart. The cost of these materials is estimated at $575,000.

TABLE VIII

DOE FUNDING FOR CURRICULUM MATERIALS *

FISCAL YEAR	1975	1976	1977	1978	TOTAL
AGENCY					
FEA	$190,000	$360,000	$277,000		$ 827,000
ERDA	---	122,000	649,000		771,000
FEA/ERDA	---	---	50,000		50,000
DOE				$600,000	600,000
				TOTAL	$2,248,000

*Not included are materials not specifically designed for schools, but made available to schools upon request from DOE or its predecessors.

IV. Educational Special Events

Several special events concerning energy education have been sponsored by the Department of Energy and its parent organizations such as awards presentations at International Science & Engineering Fairs, expense paid visits to one of the National Laboratories for Science Fair winners, national contests and competitions designed to encourage nation-wide participation by teachers and students in the creation of innovative energy projects, activities and exhibits; workshops, conferences and seminars; special studies and surveys; and special visitation programs. It must be emphasized here that although DOE sponsors many technical conferences, those described below are specifically concerned with education.

A. International Science & Engineering Fairs

The Energy Research and Development Administration has continued to sponsor the presentation of awards to high school students at International Science & Engineering Fairs, for projects demonstrating scientific excellence in some energy-related field, initiated by the Atomic Energy Commission in 1962. It has also continued the policy of the AEC of providing all expense-paid tours to one of our National Laboratories for the winners of these science fairs and their science teachers. In its 16 year history, almost $100,000 has been provided for this event.

B. National Contests and Competition

Beginning in 1975, the Energy Research and Development Administration has provided funds to help support national engineering competitions held by the Student Competitions on Relevant Engineering (SCORE), a student organization established in 1971 to coordinate intercollegiate engineering competitions. Thus far ERDA has funded two of these competitions, one in 1975 and the other in 1977. The theme of these competitions has been "Energy Resources Alternatives" which has led to the creation of a number of innovative energy systems for homes, farms and light industry.

In a national contest sponsored by the Energy Research and Development Administration in 1976, elementary, junior high, and high school teachers submitted classroom activities, used in teaching an energy lesson, to the National Science Teachers

Association, in Washington, D.C., as part of a curriculum development contract. Ten teachers were selected as winners by the NSTA and received an expense-paid trip to Washington to assist in the materials development effort. The winning activities are summarized in a booklet entitled Award Winning Energy Education Activities for Elementary and High School Teachers and is available to teachers by writing to the Department of Energy, National Technical Information Center, Oak Ridge, TN 37830.

Finally, two national contests, conducted by the ABC of American Industry, Inc. of Niagara Falls, New York, have been sponsored by the Energy Research and Development Administration for the 1976-77 and 1977-78 school years. The contests involve the creation of term projects by junior-high students related to energy activities found in a student magazine distributed by the ABC of American Industry Corporation. The projects will be judged by the Corporation and awards will be presented by the Corporation as well. A total of 2,700,000 magazines have been distributed to junior high schools throughout the country for the school year 1976-77, with an additional distribution of the same number planned for school year 1977-78.

C. Conferences, Workshops, and Seminars

Since January 1974, a total of 17 "American Nuclear Society Student Conferences" have been sponsored by the Department of Energy and its predecessors, at a total cost of approximately $48,500. The purpose of these conferences is to acquaint students, faculty, industry and government participants with the latest developments in nuclear energy and to discuss other energy-related issues facing the country. These conferences are organized by student members of the American Nuclear Society from various branches located throughout the U.S.

In May 1976, a series of five regional seminars was conducted by the Educational Testing Service of Princeton, New Jersey, under a $86,500 contract to the Federal Energy Administration. The purpose of these meetings was to assess the need for improving energy education in the Nation's schools. This was achieved by obtaining the views of about 50 teachers at each seminar. The participants included curriculum specialists, school administrators from elementary, junior and senior high schools and universities, state and county departments of

education, and national educational organizations. The 1 day seminars were held in Portland, Oregon; Atlanta, Georgia; Chicago, Illinois; Boston, Massachusetts; and Dallas, Texas. A report of the proceedings is entitled Content Analysis and Interpretation of Five Regional Hearings Conducted by the Educational Testing Service to Determine Current Status and Future Needs of In-School Energy Education. This report is available from the Office of Conservation and Solar Applications, Marketing and Education Branch, Department of Energy, Washington, D.C. 20545.

In August 1976, the Energy Research and Development Administration cosponsored and funded the "National Conference on Energy Education" in cooperation with the League for Innovation in Community Colleges. The conference was hosted by the Brookdale Community College of Lincroft, New Jersey. The objectives of the conference were to assess the state of energy education in the Nation's community colleges; to develop a selected bibliography of available educational materials related to energy education and appropriate for community college/adult education uses; and to devise a plan for initiating more significant programs of energy education throughout the nationwide community college system. The outcomes of this conference are summarized in a report entitled A National Energy Education Curriculum Evaluation and Development Conference and is available by writing to the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia, 22161.

In October 1976, a conference was sponsored by the Energy Research and Development Administration and the American Association of Community and Junior Colleges to discuss the role of community and junior colleges in training the manpower required to implement the Nation's expanding energy programs. Energy education issues were presented by panels made up of staff members of community colleges, energy-related industries, labor organizations, and Federal and state agencies. The conference was a direct result of a survey taken by the Manpower Development Division of Oak Ridge Associated Universities, under contract to ERDA, in September 1975. The conference was held in Atlanta, Georgia.

In November 1976, the Energy Research and Development Administration sponsored a workshop to examine and explore ways of successfully integrating the community college system into ERDA's conservation programs. The workshop was held in

Chicago, Illinois and was coordinated by the Charles County Community College of La Plata, Maryland. Twelve community college educators and twelve representatives from ERDA participated. The objectives of the workshop were to:

- Survey current community college programs and projects in energy conservation
- Identify new priorities for action
- Recommend strategies for implementing these priorities in the community college context.

Workshop participants recommended that Community Colleges establish close cooperation with State Energy Extension Service Offices, and that ERDA should utilize the community college system in implementing citizen education projects, and plan future workshops to study technical curriculum options. The proceedings of this workshop are summarized in a report entitled Energy Conservation Workshop for Community College Leaders and is available for $4.50 from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161. It was also recommended that ERDA utilize the community colleges, with their local base, as a means of obtaining regional inputs to planning. As a result, two other workshops have been held, hosted by community colleges, in Southern California and West Virginia.

In June 1977, a conference was sponsored by the Energy Research and Development Administration entitled "Education Confronts the Energy Dilemma." The conference was held in Washington, D.C., to discuss the challenges of the energy situation for the educational community. Educators, industry, labor, and public interest group representatives participated. A report of the proceedings is available from the U.S. Department of Energy, Technical Information Office, P.O. Box 62, Oak Ridge, Tennessee 37830.

The Energy Research and Development Administration sponsored the "Economics of Energy Workshop" conducted by the Association for University Business and Economic Research of Memphis, Tennessee, in August 1977. Held in Snowbird, Utah, the workshop presented a number of socio-economic and environmental issues for discussion by university faculty representatives, with a major emphasis being given to the examination of the effects of electrical power plants on society.

In October 1977, a workshop entitled "Energy Conservation Workshop-Training Requirements for Technicians" was sponsored by the Department of Energy to examine the relationship between the Department of Energy and the Community College for training students in energy conservation and energy-related technical skills. This workshop developed a number of conclusions and recommendations pertaining to community colleges, industry and government. A need for close communication and cooperation between industry and educational facilities was emphasized so that community colleges could provide training truly responsive to the special needs of each community and thereby increase the opportunities for the placement of graduates in energy-related fields. There were also specific recommendations for curriculum development and planning activities by DOE. It was the general consensus of those attending the workshop, that currently, there is no identifiable market to justify the creation of an energy conservation job category. Consequently, it was suggested that required training for existing professions and trades be expanded to include energy-conservation concepts and technologies. The workshop took place in Atlanta, Georgia.

In mid-December 1977, the Department of Energy sponsored a workshop entitled "The First National Workshop on Energy Efficiency Education Through Technology Transfer" in Washington, D.C. The primary goals of the workshop were: 1) to assess the potential of continuing education as a means of increasing the professional skills of engineers and scientists for energy conservation, 2) to make recommendations regarding education programs and policies needed to encourage technology transfer, 3) to identify modes of industry, university, professional society and government cooperation in this field. The workshop was conducted by members of "Project Proceed" of the Massachusetts Institute of Technology which is funded by NSF. They are currently developing continuing education modules on energy efficiency for practicing engineers.

D. Special Studies

In May 1976, the Energy Research and Development Administration initiated a contract with the American Society for Engineering Education (ASEE) to conduct a study for the purpose of developing a plan for instituting a comprehensive program of scientific education and training to support non-nuclear energy technologies. Information on the manpower requirements and educational and

training needs of engineers, scientists, technologists, technicians and other technical personnel, to meet the non-nuclear energy-related goals of the United States, was gathered and examined by a 10-member task force comprised of ASEE members. The plan has been published as an ERDA document entitled A Proposed Plan for Education and Training in Non-Nuclear and Nuclear Energy Technologies and is available from the National Technical Information Service, Department of Commerce, Springfield, Virginia 22161.

In November 1976, Navarro College of Corsicana, Texas, was contracted by the Energy Research and Development Administration to conduct a research program entitled "Assessment of the Need for Developing and Implementing Technical and Skilled Worker Training for the Solar Energy Industry." The tasks performed under this research program included the surveying of solar heating and cooling equipment used by ERDA, NASA and private industry; the reviewing of existing consumer demand studies to forecast manpower requirements; and conducting a skills study to determine the type of associate degree-level curriculum required to train solar technicians.

The Energy Research and Development Administration funded a project in August 1977, at the University of Pennsylvania, to analyze existing and planned energy management academic programs in our colleges, universities and community colleges. A summary of the principal features of each program and an analysis of the competence and skills of graduates from these programs will be published in a report expected to be completed in August of this year.

Three students from the Worcester Polytechnic Institute conducted a 6-week study (based on telephone inquiries) in September 1977, to evaluate the current employment of former participants in the 1973 and 1974 University-Laboratory Cooperative Program and the Graduate Traineeship Program. The purpose of this study was to determine whether the participants in these programs were subsequently employed in energy-related fields more or less frequently than nonparticipating scientists and engineers for the same period. The results of the study showed that, on a national basis, University Trainees and Laboratory Graduates enter energy-related fields much more frequently than other scientists and engineers.

E. Visiting Scientists Program

The Visiting Scientists Program was formulated by the AEC in 1957 for the purpose of providing universities, colleges and high schools with the opportunity of inviting distinguished scientists to their campuses to deliver lectures and conduct discussions in the areas of energy and environmental/biomedical research. Funded by the AEC and subsequently ERDA, the program is administered by the American Institute of Biological Sciences of Arlington, Virginia. The objectives of the program are to provide current scientific and technical information to the academic community; to offer career guidance and counseling to faculty and students and to build a greater awareness and understanding of energy, environmental and biomedical issues. A total of $530,353 was provided by the AEC and ERDA to fund the program.

V. Facilities Support

The Department of Energy and its predecessors have provided support to educational facilities throughout the country in the following four ways: A) by maintaining the operation of nuclear reactors housed at colleges and universities, B) by providing funds for the installation of solar electric, solar heating and cooling, and solar hot water systems in school buildings, C) by sponsoring the development and implementation of school energy conservation programs, D) by providing used energy-related laboratory equipment to colleges and universities.

A. Reactor Sharing and Fuel Assistance Program

In order to provide support to students and faculty engaged in research and training in the nuclear field, the Atomic Energy Commission established this program in 1967. Under this program, universities and colleges receive financial assistance in order to operate nuclear reactors which are used as research and teaching tools. The universities receive support in the following ways:

(1) fuel assistance, which is for the actual fabrication cost of the fuel; (2) reactor sharing, in which a portion of the operating cost of a host institution is provided when it shares its reactor with neighboring institutions; (3) spent fuel shipment, in which special arrangements are made to provide for the shipment of the radioactive spent fuel to a DOE laboratory for reprocessing; (4) losses and reprocessing of heavy water, which has been loaned to the reactor operators for flux enhancement or for special experiments; and (5) the loan or grant of neutron sources or the provision of uranium for subcritical facilities.

1. Fuel Supply and Fabrication

In addition to supplying enriched uranium at no cost for use, burnup or reprocessing, it was the policy of AEC and ERDA to provide for the fuel fabrication costs of the universities to the extent they are used for teaching and academic research. A pro rata share of these costs is borne by any industrial projects at the reactors. The demand for fuel varies with the power level and the time of operation, and since this varies from one institution to another, the refueling requirements of an individual

reactor may be from two or three times per year, to once in several years.

2. Reactor Sharing

The reactor sharing programs provide funds to defray a portion of the operating costs when the university reactor is shared with neighboring institutions. Under sharing, a neighboring institution may bring a class for a 1 day visit or, in other cases, a research group may come to the reactor with their equipment, set up and stay for a matter of several days or even several weeks.

3. Spent Fuel

As part of its assistance to universities for their fuel cycle costs, DOE provides funds for the shipment of spent fuel to a reprocessing site. Fuel is "spent" when the burnup of U-235 is such that an element can no longer be used in the reactor. Shipment of the spent fuel requires special handling and the use of large casks which have the approval of the Nuclear Regulatory Commission. There are a limited number of such casks available and they have to be scheduled considerably in advance for shipment of spent fuel from the university to the appropriate DOE site. This part of the program provides for the actual cost of leasing the cask, obtaining the necessary licensure, and for shipping it to the reprocessing or storage site.

4. Heavy Water

Heavy water is provided to some universities for certain types of experiments and for flux enhancement. The heavy water is provided out of the Savannah River Operations Office and the heavy water is shipped back to Savannah River on completion of its use for reprocessing. The program pays for any losses that have been incurred in the use of the heavy water and also for the cost of reprocessing. There have been problems in estimating costs for this activity because it is difficult to predict the actual losses from the use of the heavy water.

5. Materials Loans and Grants

Under this part of the program, neutron sources are made available either on loan or are granted to the institutions,

depending on the actual value of the source. Uranium is also made available, on a load basis for use in subcritical facilities. The institution pays whatever charges may be necessary for shipment and for handling of these materials.

TABLE IX

REACTOR SHARING AND FUEL ASSISTANCE COSTS

FISCAL YEAR	COMBINED TOTAL OF FUEL ASSISTANCE & REACTOR SHARING COSTS
1967	$ 421,000
1968	$ 232,000
1969	$ 346,500
1970	$ 460,000
1971	$ 245,000
1972	$ 470,000
1973	$ 505,000
1974	$ 495,700
1975	$ 517,255
1976	$ 494,951
1977	$ 550,000
TOTAL	$ 4,737,406

B. Installation of Solar Heating and Cooling Systems

Since the Solar Heating and Cooling Demonstration Act became a reality in 1974, a total of 40 educational facilities have been selected by the Energy Research and Development Administration to utilize solar heating and cooling equipment with an estimated total funding of $14.3 million. The purpose of the Solar Heating and Cooling Demonstration Program is to test and demonstrate the usefulness of solar heating and cooling systems in residential, commercial, and non-residential buildings.

Below is a list of the educational facilities involved and examples of the building types, project descriptions, costs, schematics, and operation dates of some of the schools chosen as demonstration sites:

TABLE X *

SOLAR HEATING AND COOLING OF EDUCATIONAL FACILITIES

STATE	BUILDING TYPE	LOCATION	SOLAR APPLICATIONS	ERDA FUNDING
Arizona	High School	Tempe, Arizona	H, HW	$ 692,100
California	Elementary School	Irvine, California	H, C, HW	$ 247,500
	High School	San Diego, California	H, C, HW	392,740
	Elementary School	San Jose, California	H, C	318,615
Colorado	Elementary School	Aurora, Colorado	H, HW	$ 33,697
	School for Trainable Retarded	Lakewood, Colorado	H	176,240
Florida	Elementary School	Coral Gables, Florida	H, C, HW	$ 850,566
Georgia	Elementary School	Atlanta, Georgia	H, C, HW	$ 912,000
Hawaii	School	Honolulu, Hawaii	C, HW	$ 265,000
Illinois	High School	St. Charles, Illinois	H, HW	$ 524,683
Indiana	Classroom/Lab. Fac.	Gary, Indiana	H	$ 109,883
	School Gymnasiums	Clarksville, Indiana	H	129,505
Iowa	Recreation Center	West Branch, Iowa	H	$ 77,289
	Scattergood School Elementary School	Marion, Iowa	H	233,459

* Amounts Accurate as of 2/21/78; Amounts Subject to Change Pending Programmatic Revisions.

TABLE X (Continued)

STATE	BUILDING TYPE	LOCATION	SOLAR APPLICATIONS	ERDA FUNDING
Kansas	School	Gypsum, Kansas	H, HW	$ 181,411
Louisiana	Field House Louisiana State University	Baton Rouge, Lousiana	H, HW	258,225
Maryland	Elementary School	Cockeysville, Maryland	H, C	$ 616,166
	Elementary School	Timonium, Maryland	H, C	1,151,020
	Campus Buildings, Montgomery College	Germantown, Maryland	H, HW	22,379
Massachusetts	School	Boston, Massachusetts	H	$ 594,000
	Educational Facility Hampshire College	Amherst, Massachusetts	H, C, HW	329,827
Michigan	College/Residence Hall	Cedar Springs, Michigan	H, HW	$ 98,660
	Elementary School	Troy, Michigan	H, HW	206,770
Minnesota	Junior High School	Brooklyn Center, Minnesota	H, HW	$ 509,633
	Bookstore, University of Minnesota	Minneapolis, Minnesota	H, C, HW	430,000 **
	Public Planetarium, Hibbing Community College	Hibbing, Minnesota	H	145,500
Missouri	Visitor Center, Stephens College	Columbia, Missouri	H	$ 88,118

** DOE Funded; Design Only

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TABLE X (Continued)

STATE	BUILDING TYPE	LOCATION	SOLAR APPLICATIONS	ERDA FUNDING
New Hampshire	Chemistry Lab, University of New Hampshire	Durham, New Hampshire	H, HW	$ 192,156
New Jersey	Auditorium/Classroom	Basking Ridge, New Jersey	H, C, HW	$ 724,000
New Mexico	Elementary School	Gallup, New Mexico	H	$ 68,000
	Office/Laboratory New Mexico State University	Las Cruces, New Mexico	H, C	155,000 ***
New York	Educational Building	Ballston Spa, New York	H, HW	$ 470,000
Ohio	Educational/Admin. Bldg. Columbus Technical Institute	Columbus, Ohio	H, C	$ 334,985
South Dakota	High School	Spearfish, South Dakota	H, HW	$ 199,502
Texas	Energy Plant, Trinity University	San Antonio, Texas	H, C, HW	$ 1,100,000
Virginia	Vocational School	Leesburg, Virginia	HW	$ 56,336
	School	Warrenton, Virginia	H	268,666

*** For Evaluation Instruments Only

TABLE X (Continued)

STATE	BUILDING TYPE	LOCATION	SOLAR APPLICATIONS	ERDA FUNDING
West Virginia	School	Charles Town, West Virginia	H, C	$ 996,853
	Educational/Conference Center Bethany College	Bethany, West Virginia	H, HW	156,820
Wisconsin	Elementary School	Howards Grove, Wisconsin	H	$ 58,835
			TOTAL	$ 14,366,113

PROJECT INFORMATION

Owner/Builder: City of Boston (Dorchester)

Contractor: General Electric Company

Operational Date: March 1974

Total Estimated DOE Funds: $594,000

Building

Type: School

Area: 61,000 sq. ft. (total); 21,000 (cond.)

Location: Boston (Dorchester), Massachusetts

Latitude: 42.4° N

Climatic Data

Degree Days	Heating	5821	Cooling	661
Avg. Temp. (°F)	Winter	42.3	Summer	70.9
Avg. Insol. (Ly/d)	Winter	248	Summer	479

SOLAR ENERGY SYSTEM

Application Heating 65% Cooling 0% Hot Water 0%

Collector

Type: Liquid flat-plate

Area (sq. ft.): 4,600

Manufacturer: General Electric Company

Storage

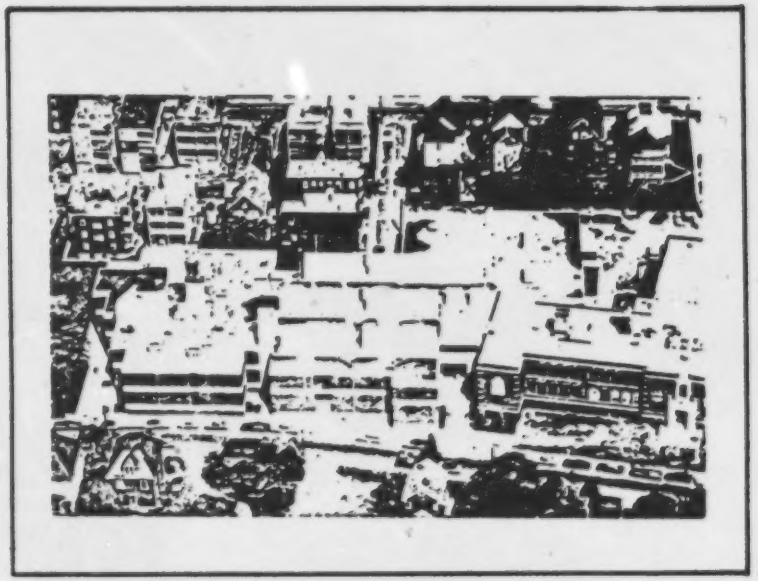
Type: Water

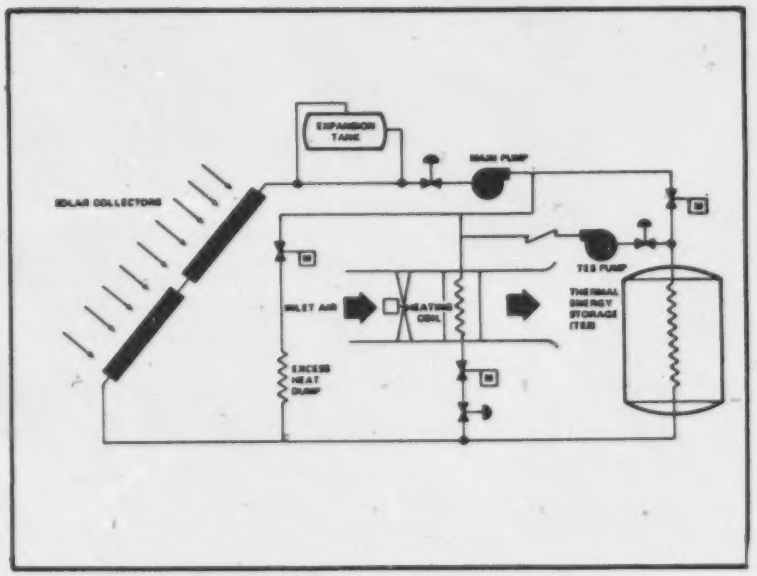
Capacity: 2,000 gallons

Auxiliary System Type: Electric

PROJECT DESCRIPTION

In 41 days this 144 collector, rooftop solar heating system was designed, fabricated, and installed on the Grover Cleveland School in Boston under National Science Foundation sponsorship. This was followed by an operation and evaluation period during which the system provided about 50% of the heating needs for the 21000 sq. ft. area of the school. In the fall of 1974, the system provided all the heat until early December, when it was discovered that the conventional electric resistant heating had been inadvertently left off following summer servicing. Early in 1976, the system was refurbished, the control system simplified, and the ethylene glycol heat transfer fluid replaced with silicone oil. Since then, the system has performed well in a fully automatic mode without maintenance. The city of Boston accepted ownership of the installation in 1977.





PROJECT INFORMATION

Owner/Builder: Baltimore County

Contractor: AAI Corporation

Operatonal Date: March 1974 (heating); May 1975 (cooling)

Total Estimated DOE Funds: $1,151,020

Building

Type: Elementary school

Area: 60,000 sq. ft. (total); 10,000 (cond.)

Location: Timonium, Maryland

Latitude: 39.5°N

Climatic Data

Degree Days	Heating	4729	Cooling	1108
Avg. Temp. (°F)	Winter	45.9	Summer	73.1
Avg. Insol. (Ly/d)	Winter	288	Summer	488

SOLAR ENERGY SYSTEM

Application Heating 50% Cooling √ Hot Water 0%

Collector

Type: Liquid flat-plate/reflector

Area (sq. ft.): 4,250/5,300

Manufacturer: AAI Corporation

Storage

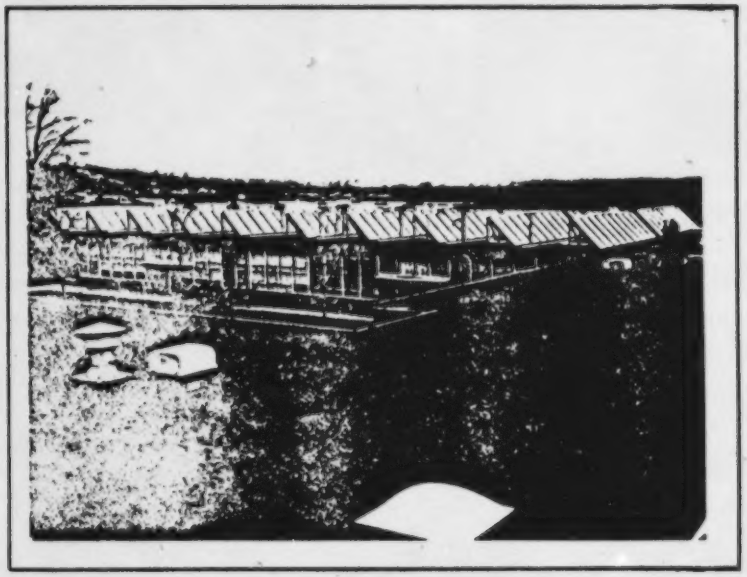
Type Water (deionized)

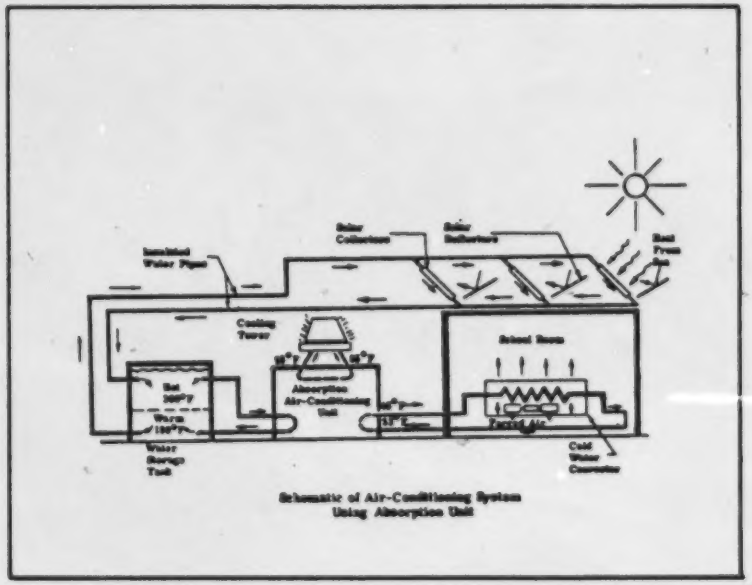
Capacity. 15,000 gallons (hot); 40,000 gallons (chilled)

Auxiliary System Type: Oil boiler

PROJECT DESCRIPTION

This project provided for the design, fabrication, and installation of a retrofit solar heating and cooling system for one wing of the Timonium Elementary School. The solar system consists of liquid honeycomb construction flat-plate collectors with fixed mirrors, hot and cold storage tank, and a 150-ton York absorption chiller. Two principal modifications were made. A cooling tower was added and a condensate drain line was run to convectors in the classrooms. This was the first school in the U.S. to have solar heating and cooling. The project also called for studies of the feasibility of installing systems similar to this in other buildings.





Schematic of Air-Conditioning System Using Absorption Unit

PROJECT INFORMATION

Owner/Builder: Osseo School District

Contractor: Honeywell, Inc.

Operational Date: April 1974

Total Estimated DOE Funds: $509,633

Building

Type: Junior high school

Area: 165,583 sq. ft. (total); one room (cond.)

Location: Brooklyn Center, Minnesota

Latitude: 45.1°N

Climatic Data

Degree Days	Heating	8159	Cooling	585
Avg. Temp. (°F)	Winter	35.6	Summer	69.7
Avg. Insol. (Ly/d)	Winter	269	Summer	516

SOLAR ENERGY SYSTEM

Application Heating 54% Cooling 0% Hot Water 21%

Collector

Type: Liquid flat-plate

Area (sq. ft.): 5,000

Manufacturer: Honeywell, Inc.

Storage

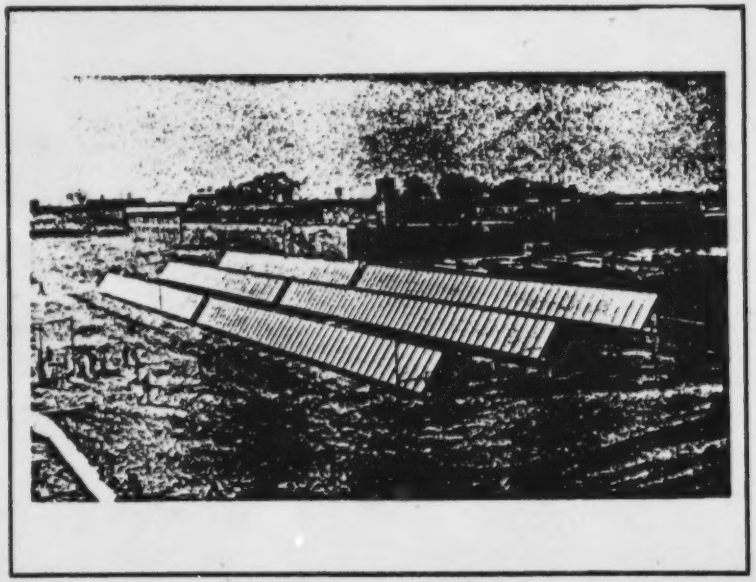
Type: Ethylene glycol water solution

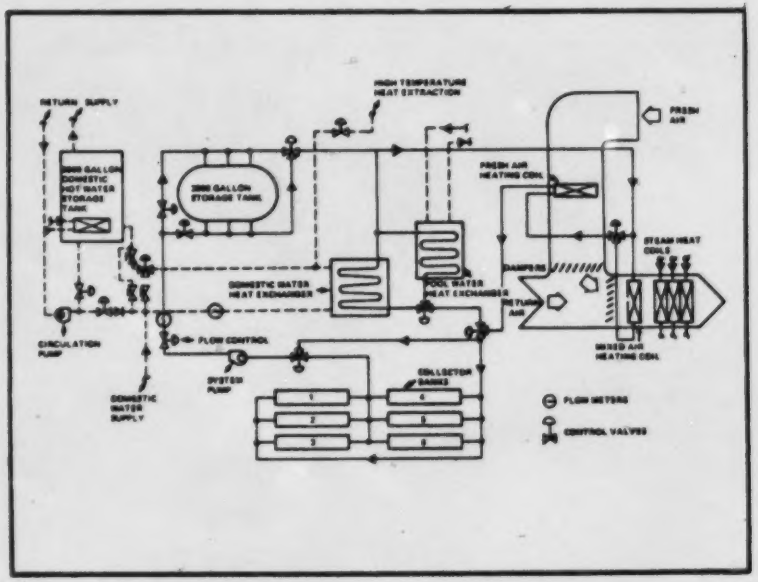
Capacity: 3,000 gallons

Auxiliary System Type: Gas fired boiler

PROJECT DESCRIPTION

This project provides for the design, installation, and testing of a solar energy system for the North View Junior High School. The system meets a part of the space and hot water heating requirements of the school's indoor swimming pool. During the first year of system operation, the performance of the system was evaluated, and a heat exchanger was installed in the swimming pool's recirculation system. The Tedlar film on one-sixth of the collectors was replaced with a second antireflective cover glass, and collector performance has been reevaluated. Besides reducing energy consumption, this system should provide useful data on solar collection and system performance. The data can be used in designing similar systems for other schools and in future research and development work.





PROJECT INFORMATION

Owner/Builder: Fauquier County

Contractor: InterTechnology Solar Corporation (ITSC)

Operational Date: February 1978

Total Estimated DOE Funds: $268,666

Building

Type: School

Area: 4,100 sq. ft.

Location: Warrenton, Virginia

Latitude: 38.9° N

Climatic Data

Degree Days	Heating	4217	Cooling	1330
Avg. Temp. (°F)	Winter	43.1	Summer	70.0
Avg. Insol. (Ly/d)	Winter	269	Summer	489

SOLAR ENERGY SYSTEM

Application Heating 60% Cooling 0% Hot Water 0%

Collector

Type: Liquid flat-plate

Area (sq. ft.): 1,600

Manufacturer: InterTechnology Solar Corporation

Storage

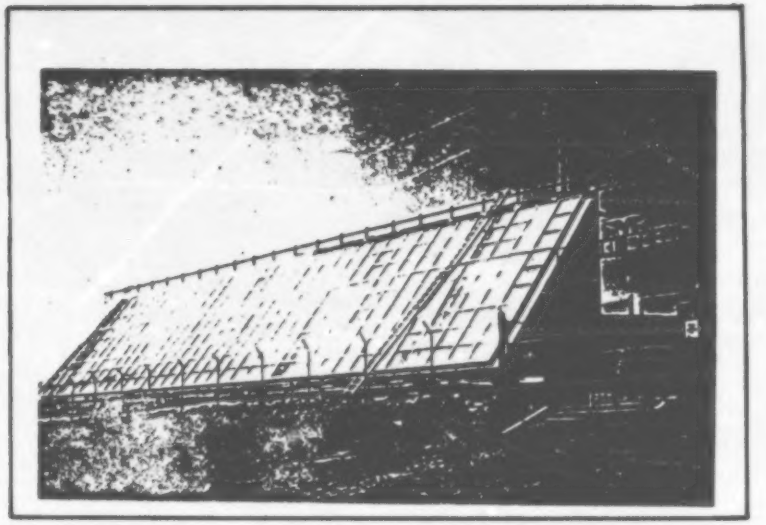
Type: Water

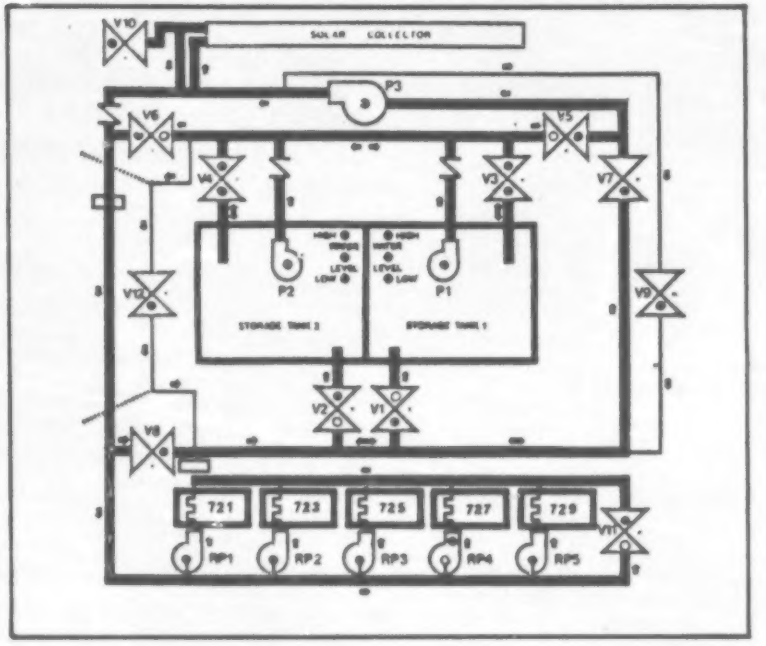
Capacity: 10,000 gallons

Auxiliary System Type: Electric, oil

PROJECT DESCRIPTION

This project aimed at determining whether solar energy could supply a substantial part of the heating requirements of a school, at estimating the cost of installing and maintaining such a system, and at determining the savings in fuel that would be realized from its installation. The system was developed and became operational early in 1974. Since that time it has supplied all heating requirements of the 5 detached classrooms that it was designed to serve. System efficiency for full-day heating ranges between 40 and 60%. The total thermal storage system, which uses 10000 gallons of water as a storage medium, can meet all heating requirements for twelve days without sunlight. The original solar collector constructed for this project consisted of 2540 sq. ft. of collector surface, the collector modules being assembled on a support structure measuring 26 ft by 26 ft. For the refurbishment, 1600 sq. ft. of ITSC's Solar Mark III collectors with black chrome coating are being used in place of the original collector.





In September 1976, funds were provided by the Energy Research and Development Administration to build an educational facility known as the Upland Hills Ecological Awareness Center. The purpose of the Center is to demonstrate "nonpolluting" forms of energy such as solar energy for water and space heating, wind power for electricity and methane for auxiliary fuel. The Center is located in Oxford, Michigan, and operates in conjunction with the Upland Hills Farm School, a small private grade school which emphasizes environmental, energy and conservation principles.

In addition to the solar heating and cooling of school buildings, the Energy Research and Development Administration announced, in the summer of 1977, plans to install photovoltaic solar cells for the Mississippi County Community College of Blytheville, Arkansas. These solar cells are designed to convert sunlight into electricity.

The solar cell array, similar to those used to provide electrical power for many of the Nation's spacecraft, will be the largest photovoltaic system ever assembled and will have an expected peak output of 250,000 watts.

In addition to electricity, the 50,000-square foot building will use the sun for space and hot water heating and will employ a variety of new energy conservation features.

The solar-powered facility is scheduled for operation in mid-1979. The total DOE funding for this project is estimated at $6.3 million with an additional $2.5 million being raised by Mississippi County for the construction of the new building.

In addition to the solar collector system, the Blytheville College will also test a new type of advanced storage battery to provide electricity for the school during inclement weather or at night. The storage system is being developed by GEL, Inc., a small company based in North Carolina. The batteries will be charged with either excess electricity produced by the solar cells or electricity supplied by a local utility during periods of low demand.

The classroom building will also use both architectural and landscaping features to minimize energy use. Thick walls, special insulation, novel lighting techniques, windows of

tinted glass, and earthen windbreaks will be incorporated into the building project. Classes and activities will be coordinated by computers to minimize the need for energy. Heaviest workloads would be scheduled during the morning and evening hours.

Mississippi County Community College also proposes to establish a 2-year degree program to train solar engineering technicians through "hands-on" use and maintenance of the college's solar equipment.

C. Implementation of Conservation Programs

In an effort to curtail the increasing costs of energy use in our Nation's schools (See Table XII), the Federal Energy Administration supported the development of the Public School Energy Conservation Service (PSECS) in 1974, at a cost of nearly $300,000. The service, developed and conducted by the Educational Facilities Laboratories, Inc. (EFL) of Menlo Park, California, is designed to help schools define where and how they can save energy. The table below, prepared by the EFL, shows the potential national energy savings in energy use in our elementary and secondary schools based on the 1975-1976 school year if PSECS guidelines are followed:

TABLE XI

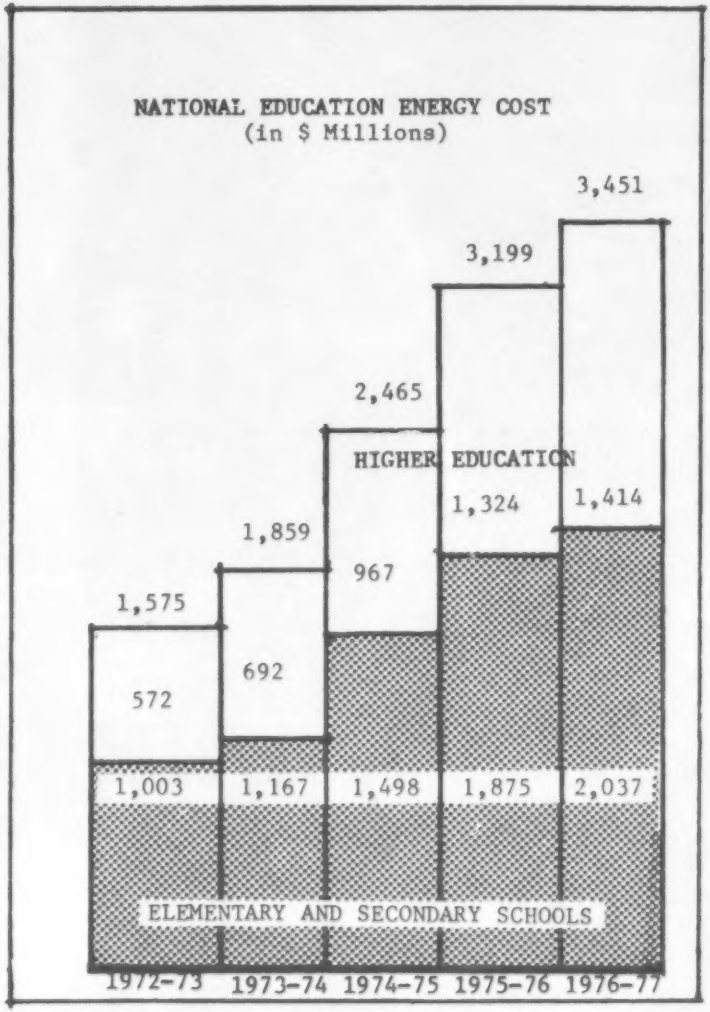
Estimated Savings in Electricity, Fuel, and Dollars Achieved by Operating all U.S. Public Elementary and Secondary Schools at PSECS Guideline

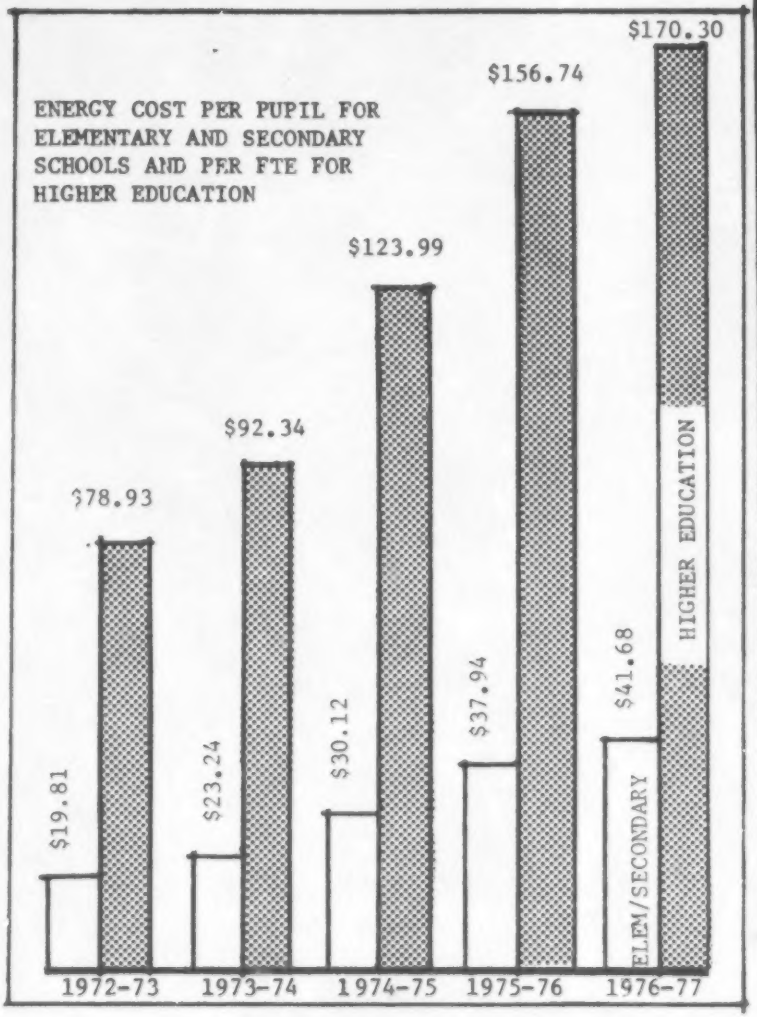
Savings in Millions

		Electricity		Fuel		
Level	No. of Schools	kwh	$	Therms	$	Total Savings
Elementary	60,624	3,493	$104.8	821.3	$164.3	$269.1
Secondary	24,730	7,116	213.5	916.7	183.3	396.8
Total	85,354	10,610	$318.3	1,738.0	$347.6	$665.9

Note: The following costs were used: Electricity $0.03/kwh, Fuel $0.20/Therm.

TABLE XII


NATIONAL EDUCATION ENERGY COST
(in $ Millions)
3,451
3,199
2,465
1,859
1,575
HIGHER EDUCATION
1,324
1,414
967
692
572
1,003
1,167
1,498
1,875
2,037
ELEMENTARY AND SECONDARY SCHOOLS
1972-73
1973-74
1974-75
1975-76
1976-77


ENERGY COST PER PUPIL FOR
ELEMENTARY AND SECONDARY
SCHOOLS AND PER FTE FOR
HIGHER EDUCATION
$170.30
$156.74
$123.99
$92.34
$78.93
$19.81
$23.24
$30.12
$37.94
$41.68
ELEM/SECONDARY
HIGHER EDUCATION
1972-73
1973-74
1974-75
1975-76
1976-77

PSECS Guidelines recommend the implementation of conservation measures for each school based on a computerized energy audit of each school building.

Schools interested in this service should write to: Educational Facilities Laboratories, Inc., 3000 Sand Hill Road, Menlo Park, California 94025. The fees for this service are $30 for elementary schools and $50 for secondary schools.

Chicago Project

In 1975, the Federal Energy Administration provided $121,000 to support the "Chicago Project" which was conducted by the State of Minnesota Energy Agency using the PSECS computerized energy audit in 60 school buildings in Michigan, Illinois, Wisconsin, Ohio and Indiana.

Conservation Workshops

From September 1976, to January 1977, 20 energy-conservation workshops were sponsored by the Federal Energy Administration, at a cost of $215,000 to provide technical assistance to school plant managers and business officials for energy management in public and university facilities. The workshop materials produced by the workshops have been made available to the State Energy Offices.

ASSA Ten Schools Project

Beginning in the summer of 1977, under the sponsorship of the Energy Research and Development Administration, 10 elementary school buildings are being modified for the installation of energy-saving measures such as added insulation, boiler improvements, adjustments in ventilation systems, and lighting changes in an effort to reduce energy consumption by an average of 50 percent. The overall purpose of the project is to measure the impact of these conservation measures in terms of how much money and energy can be saved. By using this information, school administrators will be able to determine effective conservation policies for their own school buildings.

The project originated from a survey conducted by the Federal Energy Administration in 1976 to determine the potential savings of conservation measures in school buildings. Ten schools were selected from various regions of the country and specific energy-saving techniques and costs were identified for each of the schools. Those measures from the survey, found to be cost effective over the life of the building, were selected by the Energy Research and Development Administration for implementation.

The 10 schools are: Harold C. Scott Elementary School, Warwick, Rhode Island; Central Elementary School, Glen Rock, New Jersey; Samual Everitt Elementary School, Langhorne, Pennsylvania; Hindman Elementary School, Hindman, Kentucky; Fairmoor Elementary, Columbus, Ohio; P. F. Brown, Lubbock, Texas; Eastbridge Elementary School, Lincoln, Nebraska; Garfield Elementary School, Sioux Falls, South Dakota; Washington Elementary School, Kennewick, Washington; and Plover Whiting Elementary School, Stevens Point, Wisconsin.

The total DOE support for the project is estimated at $600,000. About $450,000 to $500,000 of that will be for instrumentation, monitoring and analysis work. The remainder will go for part of the design and installation of the energy-saving measures themselves.

The American Association of School Administrators (AASA) of Arlington, Virginia, is carrying out the project under the direction of the Lawrence Berkeley Laboratory of the Department of Energy.

Summary: AASA "Ten Schools Project"

Location	Year built and sq. ft.	Fuel	Modification	Actual Cost	Recovery time
Warwick, R.I.	1965, 67 27,610	gas	1.reduce outside air 2.night setback 3. 4.add roof insulation	$44,885	5 years
Glen Rock, N.J.	1925,39,50 45,384	oil	1.reduce outside air 2.new burners 3.change temperature settings 4.dampers 5.roof insulation 6.reduce infiltration	43,550	5 years
Langhorne, Pa.	1954,58,67 49,314	oil	1.reduce outside air 2.replace burners	23,320	9 years
Hindman, Ky.	1957, 66 32,338	gas	1.increase boiler efficiency 2.reduce glass 60%	13,700*	6.3 years
Columbus, Ohio	1949, 55 42,765	gas	1.shut down unit vents, summer 2.improve boiler efficiency 3.night setback 4.reduce outside air	25,700*	3 years
Lubbock, Tex.	1949,50,56 36,802	gas	1.update and improve controls	496	8 months
Lincoln, Neb.	1954, 55 32,029	gas/ oil	1.reset and rebalance air handling units 2.night setback	8,577	4 years
Sioux Falls, S.D.	1952, 56 33,000	gas/ oil	1.reduce outside air 2.night setback 3.improve boiler efficiency	23,946	10 years

* estimated cost

Summary: AASA "Ten Schools Project"

Location	Year built and sq. ft.	Fuel	Modification	Actual Cost	Recovery time
Stevens Point, Wisc.	1973 44,000	gas	1.improve air-conditioning usage schedule 2.improve indoor lighting schedule 3.air temperature reset 4.reduce outside air	4,320	1 year
Kennewick, Wash.	1957 40,124	gas	1.mechanical adjustments 2.night setback 3.roof insulation 4.reduce glass 5.replace incandescent lighting	88,254	7 years

TABLE XIII

SCHOOL CONSERVATION PROGRAMS
FUNDING

Project	Amount
"Chicago Project"	$ 121,000
PSECS	298,094
FEA Conservation Workshops	215,000
AASA Ten School Project	600,000
TOTAL	$1,234,094

In the proposed National Energy Act, now before Congress (February 1978), a total of $900 million is allocated for the taking of preliminary energy audits and the design, acquisition, evaluation, and installation of conservation measures in schools and hospitals. The bill provides for $25 million in preliminary audits and $875 million to cover the costs of the conservation measures themselves. A minimum of $242.5 million

of the $875 million is guaranteed for schools. The proposed legislation includes three grant programs, over 3 years, which finance up to 50 percent of the costs of the project. The three grant programs are:

Preliminary Energy Audits - grants to States to assist schools and hospitals

Technical Assistance - (Detailed energy audits) - grants to States and schools and hospitals

Projects - grants to schools and hospitals in payment of project costs (design, acquisition, and installation of conservation measures)

D. Used Laboratory Equipment Program

In order to provide support to colleges and universities for nuclear-oriented educational activities, the AEC initiated a program in the mid-50's whereby financial grants were made for the purchase of new nuclear-type laboratory equipment. This program operated for approximately 10 years and was followed by the Used Nuclear-Related Equipment Grants Program; a program which granted used nuclear-type laboratory equipment from AEC and ERDA laboratories to institutions of higher education. This program was changed to include all used energy-related laboratory equipment in 1977 and operates currently as the Used Energy-Related Laboratory Equipment Grants Program. The program is administered by the DOE Property Management Offices in the regional field offices with central coordination through the Department of Energy's Education Programs Division.

VI. Energy Extension Service

Energy Extension Service activities directly relating to schools are described below. It should be emphasized that these programs have been designed by each state, not the Department of Energy, and will be administered by the states.

A. Michigan

In Michigan, there are two major energy education objectives incorporated within its Energy Extension Service program. The first is to create an Energy Conservation Ethic in 50,000 high school age young people. In order to accomplish this objective, four steps have been formulated. These steps are:

1. Staff Training of Teachers, Cooperative Extension Service Field Agents and 4-H Leaders

   An initial step in addressing this objective is to provide that student leaders, 4-H leaders and teachers are well informed on energy issues and prepared to impart their knowledge to young people. Each school system in Michigan is part of an Intermediate School District (ISD). For each of the target counties, the ISD will hold in-service training for teachers. These sessions will be aimed at both physical science and social studies teachers so that all students have at least one teacher who has gone through training. County extension agents and 4-H leaders will also attend professional seminars.

2. Dissemination of Information Materials

   Information materials will then be made available at each school through various classes. The surveys taken to assist the evaluation effort will be available to students for self-instruction devices.

3. Designing Displays and Projects for Energy Fairs

   To promote a high interest in energy education and to help students find how they can take part in solving the energy problem, "energy fairs" will be held in at least 25 percent of the high schools with 4-H groups. This device has proven valuable in addressing science and career planning issues. It also can facilitate the involvement

of the student's family in energy conservation and will provide students not participating, with the information in a dramatic, visual way.

4. School Assembly Presentations

Special assembly presentations will be made to the student bodies by 4-H "teen leaders" and utility companies.

The second major energy education objective stated by Michigan is to reduce the energy consumption by at least 5 percent in at least 50 percent of the families with members in high school. There are two steps involved in meeting this objective. These are:

1. Home Energy Consumption Audits (including transportation consumption)

As part of class and club assignments, at least 75 percent of the students in grades 11 and 12 and a percentage as yet undetermined of those in grades 9 and 10, would perform energy audits for their residences. Energy audit forms will be prepared by the Michigan Energy Administration. In many cases, the audits will be computer calculated. Several types of audits have been tried in Michigan and throughout the country, but rarely has this mechanism been attempted to this degree and with such tight evaluation controls. The audits will review the living structures for such things as thermostat settings and weatherstripping needs, but also family transportation consumption. The completed forms will be reviewed in-depth in class. Instruction will be provided in the methods necessary to implement changes.

2. "Shop Courses," Vocational Education Curriculum, and 4-H Projects

To take the "how to" knowledge past the first simple steps, "shop courses," vocational education curricula, and the 4-H "You Can Do It" home repair program, will give added instruction in the technology of retrofitting. Instruction in this technology for the high school aged individual could result in many families insulating and performing other conservation-related tasks for their homes.

B. Texas

In Texas, one of the energy-conservation goals is directed toward public institutions such as local government buildings, state agencies and public schools. In order to reach the schools, materials are being developed to be used by city and county executives in energy-conservation presentations.

C. Tennessee

In an effort to cut down the energy consumption in its city/county institutions including public schools, Tennessee has designed a five-part plan to conserve energy in these facilities by achieving the following:

1. Develop and implement building codes which emphasize energy conservation.

2. Train and assist in developing procurement policies which consider energy conservation and life-cycle costing features in buildings.

3. Assist in analyzing and managing energy use in public buildings.

4. Assist in identifying opportunities for future retrofitting of existing buildings with energy conserving technology and identify private engineer consulting firms to perform detailed engineering studies.

5. Assist educational facilities in developing curricula addressed to energy management and energy conservation.

D. Washington

In Washington, schools form an important target audience to be reached by the Energy Extension Service. This focus on the schools will involve the conservation of energy in the school building itself and the development of energy education curricula. To implement the saving of energy in school buildings, a team of technical specialists will work with decisionmakers to clarify self-interest and arrive at policies and plans which promote energy conservation or conversion to alternate renewable resources. This work might include energy audits, seminars, workshops, and courses for decisionmakers to aid them in developing energy conservation plans.

In order to provide curriculum materials to school children, a team of technical specialists will work with curriculum decisionmakers to arrive at plans which promote energy conservation or conversion to alternate renewable resources. This might include workshops, courses, seminars, development of teaching materials which provide training in the theory, practice, and teaching of conservation or conversion to alternate renewable resources.

Once curriculum decisions have been made, the energy extension agent, technical specialists, other professionals, or volunteers will assist in their implementation. This could take the form of various types of teacher training, assistance in classroom teaching, mobilization of student volunteers, or other similar activities.

E. Connecticut

In its Energy Extension Service program, Connecticut's concern for energy conservation in the schools is reflected in its objective to increase the level of knowledge about energy conservation in public school and local governmental facilities in a minimum of 100 out of 169 Connecticut towns.

F. Pennsylvania

The elementary and secondary educational system uses 4,350 school buildings in Pennsylvania. Of these, 581 have been identified as needing remodeling in order to extend their use for 10 to 15 years. These buildings represent the implementation of energy conservation technologies proposed by the State. The State also plans to implement community development-energy conservation projects for school district officials and to distribute materials on energy conservation.

G. Wyoming

In Wyoming, over 220,000 residents are expected to benefit from home weatherization and conservation demonstrations displayed at 7 community colleges. In addition, 25 renewable resource monitoring stations will offer demonstrations on the availability of wind and solar energy in specific geographical regions. These stations are located at high schools throughout the state, and also serve as the focus for energy conservation courses offered by the Wyoming Energy Extension Service at the high schools.

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